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THE GAS JOURNAL

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Gas as a Modern Illuminant.

A UNIQUE opportunity has been provided by the International Illumination Congress for emphasizing the value of gas as a modern illuminant; and that is accomplished in this issue of the "JOURNAL" by the reproduction of an extensive series of convincing and unusual photographs, and a great deal of the information advanced at the Congress. Our number to-day will therefore be of special value.

THE EDITOR.

B.C.G.A. Conference

SUCH is the activity of the great Gas Industry—which so often suffers from grievous under-estimation of its vitality—that we find increasing difficulty in keeping pace with it. While still in the throes of the International Illumination Congress, in which our Industry is taking so great a share, we have received the programme of the Twentieth Annual General Meeting and Conference of the British Commercial Gas Association, to be held at Exeter at the end of this month; dates and details will be found in this issue of the "JOURNAL."

Ever since the announcement made at the Bridlington-Hull meeting last year that Mr. John E. Daw, J.P., Chairman of the Exeter Gas Light and Coke Company, had consented to become President of the Association, we have all been looking forward to an enjoyable time in Devonshire's attractive Cathedral City, and the programme does nothing to dull the keenness of our anticipation. Those who are able to take part in the proceedings—and the number will include all who can in any way manage to be present—are assured of a hearty welcome, and of technical fare of sterling worth to those on the distribution side of the Industry. No doubt most have long since made their reservations; stragglers should lose no time in falling into line. The inaugural meetings will embrace a lecture that none should miss; and equally important will it be to remain for the final business item of the conference—the discussion on Mr. Harold Whitehead's confidential report to the Executive Committee of the Association on his survey of selling and service methods in the Gas Industry.

"Use More Light"

"WE have tried to organize a congress which will interpret the resolutions passed at the last meeting in the United States." By this simple statement, the President of the International Commission on Illumination, Mr. Clifford C. Paterson, explained at the Official Banquet of the International Illumination Congress, a matter out of which has arisen much curiosity on the part of Londoners. For during the week (and it is a state of affairs which continues) parts of London have been lighted as they have never been lighted before, but as they can, at not too great an expense, be lighted in the future; and this has been done in connection with the Illumination Congress. A few hands have, we understand—though only on hearsay—been raised in horror at indulgence in lighting of this character, when economy is the order of the day. True, the illumination referred to—floodlighting on an extensive scale—is really magnificent, but objectors were met by the declaration of the President that "not one penny of the expense has been borne by the community in general."

So much for the "cons," now how about the "pros?" This gorgeous floodlighting has revealed London as though it had been touched by a magician's wand. Beauties that few had noticed before, objects that had been passed by as though they did not exist, have been transformed into pictures that might have been torn from the Book of Fairyland. The display—free in the sense that the cost has been defrayed by private firms, and not out of the public purse; free in the sense that all can see it without charge—has taken London by storm. Within the hour, it sprang into a popularity which proved embarrassing to those responsible for the keeping of law and order. On any night since the floodlighting started, the vast crowds of sightseers, the interminable lines of vehicles have provided sights as amazing as the illuminations themselves.

And who shall set a limit to the effects of such propaganda; who shall measure its value in the direction suggested by our slogan, "Use More Light?" Here is a slogan infinitely more precious than (say) "Eat More Bananas." Think what it represents, as pointed out by Sir Hugo Hirst at the Banquet: Better lighting means brighter homes, offices, and factories, improved health, greater safety on the roads, less crime, more cheerfulness, and increased happiness. All this, if the community will but cultivate the "light habit;" and London's illuminations will go far towards inducing them to do so. Mark well, the slogan is a co-operative one, as the floodlighting itself is co-operative. The spirit of co-operation, we are told, was first manifested by a willingness to co-operate on the part of the makers of floodlighting equipment. The next step was the readiness of the gas and electric supply authorities to participate. The cable makers, lamp makers, and electrical contractors all agreed that they would share in the work. The same readiness to help was found when approach was made to the Government Departments, Local Authorities, and others, from whom permits and facilities had to be sought.

Co-operation and Organization

GAS and electricity have proceeded hand in hand in carrying out a programme which must benefit both. It has been an excellent example of that co-operation which the "JOURNAL" is always glad to note. Our Industry can never resign its claim to a goodly share of the light-

ing load, as there are so many conditions in which this claim is justified, but that is no reason why it should not progress side by side with electricity, as has been the case elsewhere. By the floodlighting of St. James's Park, and by the Class A lighting demonstration in Whitehall, gas fully establishes its right to a place in the front rank as an illuminating agent. Neither installation could be excelled by any other means.

But in addition to the co-operative element, there is another respect in which this congress is remarkable, and that is in the matter of organization. Throughout the London proceedings—and there is reason to believe that a similar state of affairs will prevail during the visits since in progress to Glasgow, Edinburgh, Sheffield, Buxton, and Cambridge—the entire organization attained the highest pitch of efficiency. To those responsible this knowledge is the highest reward, but at the same time one name must be mentioned, that of Mr. Peter Good, Chairman of the London Local Committee. On the very first day, Tuesday, the completeness of the arrangements was thoroughly tested, when a twelve-hour programme was carried through without a hitch. At the Inaugural Luncheon at the Savoy Hotel—Lieut.-Col. Kenelm Edgcumbe, R.E. (T.), Chairman of the General Council of the International Illumination Congress, presiding—there must have been between 400 and 500 ladies and gentlemen present; and this was followed by a trip in three river steamers to the King George V. Dock, after which one of the steamers proceeded to the Beckton Gas-Works, and the two others to the Deptford Electric Power Station. Those who went to Beckton—as doubtless did also those who proceeded to Deptford—found that every preparation had been made by the Gas Light and Coke Company for their comfort; and on the way back they enjoyed a programme of music by the Beckton Gas-Works Band.

Later the three boats returned to the Royal Naval College, Greenwich, where supper was served in the open air, amid a scene of captivating beauty. In such surroundings the mind was tempted to wander. One thought of Vivian B. Lewes, from whose unsurpassed talents as a lecturer the Gas Industry derived incalculable benefit, and whose name was for long years associated with the Royal Naval College. How pleased he would have been to be present, and to take a share in this More Light Movement! And Leon Gaster. With what pride would he have regarded this fulfilment of his dreams. The Science of Illumination so firmly established and so virile that it is now making a stir throughout the world! Assuredly, the foundations were well and truly laid.

Verily, Tuesday was to be a night with the past; for, after re-joining the boats, we were brought to the Tower of London, which had been specially lighted for the occasion—and lighted in such a manner as to take us back through the centuries. No shades of the Gas Industry's pioneers here; but scenes which must have impressed themselves indelibly upon the memories of all the visitors. Those who saw for the first time on this occasion, with the aid of the Illuminating Engineer, the awe-inspiring stronghold with which the history of England is so closely interwoven, are indeed to be envied. Then, having seen what an artist in illumination could do with this ancient pile, the steamers were once more requisitioned to show us the floodlighting and illuminations from the river. Beginning with the Tower Bridge, and ending with Thames House, the sight was a never-to-be-forgotten one. A short drive to see other illuminated buildings concluded a tour which had been made without a hitch.

Safety, Attraction, and Progress

THERE are special reasons why attention to the illumination of seaside resorts is necessary. Among these are the factors of safety and attraction. Regarding the first there is a certain abandon—perhaps pardonable—among holiday-makers in the crossing of busy thoroughfares which, in the more popular places, are usually crowded to their limits with all types and sizes of motor vehicles; regarding the second, people in gay mood, the holiday mood, demand bright surroundings. A third factor is that good lighting brings business to the tradespeople of the town. Few people, we suggest, appreciate the part which gas lighting plays in popularizing seaside resorts; and we suggest also that the civic authorities of some coastal towns might to their great advantage study the cost of modern gas lighting in relation to the proved benefits which accrue from its exploitation. In this respect the paper by Mr. A. P. Allan and Mr. J. M. Campbell, who respectively deal with the gas lighting of two of the most popular and progressive seaside towns in this country, will prove of the greatest value; and the statistics which are put forward ought to encourage all in the Gas Industry to renewed efforts to demonstrate the capabilities of gas as a modern illuminant. In connection with these statistics, we would emphasize that, in the 153 principal towns and villages on the sea-coast of Great Britain where there are gas undertakings, there are over 125,000 gas lamps in use for public lighting. And our readers will note with more than a little satisfaction the comparative table which the authors give relating to 49 typical seaside resorts in this country.

Turning for a moment to the particular examples treated by Mr. Allan and Mr. Campbell, we think our readers will agree that both the authors of the paper and the municipal authorities of Scarborough and Margate deserve praise for the excellent progress which they have effected during the past few years—progress which redounds to the credit and enhances the prestige of the Gas Industry. Also a word of praise is merited by the manufacturers of the efficient equipment in use in both the places mentioned. Taking the "Queen of Watering Places" first, all its promenades and streets are lighted throughout by gas lamps, automatically lighted and extinguished, and never at any time has there been a failure of the public lighting. As for the progress made, while the annual consumption of gas for public lighting is now about four times as much as it was eight years ago, and the cost of lighting has been doubled in this period, it is interesting that the total illumination provided has been increased at least sixfold. The progress made in the lighting of Margate (where the public street and promenade lighting is almost entirely by gas) during the past few years is equally gratifying and equally significant of what the Gas Industry is able to offer the public to-day. Let us quote a few statistics: The number of lamps in use in Margate in 1927 was 1354; by 1930 the figure was 1656—an increase of 25 p.ct. in the three years. The illumination provided has been more than doubled in this period. Here again, automatic control has led not only to a great improvement in the efficiency of the illumination, but to a substantial reduction in the lighting rate.

The paper, which will be found on later pages of this issue of the "JOURNAL," provides considerable detailed information as to the methods of spacing, types of lamp, and so on, adopted; and this information will be of practical value. The paper also indicates why the lighting authorities are enthusiastic about gas lighting and how this enthusiasm was engendered. It is almost unnecessary to say that it was not engendered without effort. The Isle of Thanet Gas Company, for example, on its own initiative—and this is very important—installs lamps of new design in suitable places, so that the members of the Corporation Lighting Committee may see the results and decide whether a change from the older systems to a more modern one is worth while. Then in both Scarborough and Margate the lighting is broadly planned as a consistent scheme, and there is strict adherence to the policy of effective maintenance. There is no need for us to go into any detail concerning this here, but we offer no excuse for quoting the following, for it demonstrates the value of adequate maintenance work as well as the efficiency of modern gas lighting equipment: "Although Scarborough, like most seaside towns, is subject to gales, the average mantle usage during the last five years has been only 3·2 per nozzle per annum. Yet it is true to say that, on most occasions, a tour of the district will not reveal a single mantle which is not in perfect condition."

Finally, we would observe that the admirable paper of Mr. Allan and Mr. Campbell contains excellent propaganda material, and that full use should be made of it.

Street Lighting in South London

As is the case with the paper by Mr. Allan and Mr. Campbell, so the contribution to the Illumination Congress by the Public Lighting Department of the South Metropolitan Gas Company constitutes splendid propaganda material for the Gas Industry. It is good to realize, for example, that over 90 p.ct. of the total length of streets within the statutory area of supply of the South Metropolitan Gas Company is illuminated by gas, the number of public gas lamps in the area being 24,529. And as cost is a primary consideration in public lighting, it is worthy of emphasis that, within the Company's area, the average cost of street lighting per mile per annum is almost halved in those boroughs in which the public lighting is entirely by gas, compared with those boroughs in which gas and electricity share the public lighting load. The improvement in efficiency of equipment brought about by the general research work of the Industry and by the research work of the South Metropolitan Gas Company, coupled with an efficient system of maintenance, has been one factor in bringing about this happy result—the other factor, of course, being the low intrinsic cost of gas compared, on a heat unit basis, with electricity. In 1902, when upright incandescent burners were introduced throughout the Company's district, a cubic foot of gas gave 14 candle-hours; to-day, with inverted preheater cluster burners in general use, the figure is 25 candle-hours.

Among the later developments in lighting adopted with great success by the Company is the system of lighting main thoroughfares by centrally-suspended high-pressure lamps. Our readers will recollect the test which was carried out last year with this system in competition with electricity, and how gas emerged triumphant. As an outcome of this test, which was carried out in Lewisham, extensive centrally-suspended high-pressure gas lighting installations, having a total length of about 11 miles, have been erected in the boroughs of Deptford, Greenwich, Lambeth, Lewisham, and Wandsworth; and the Lewisham Council adopted the system for all their main streets over 50 ft. in width.

Now in regard to street lighting in general, the South Metropolitan Gas Company strongly criticize the 1927 Street Lighting Specification of the British Engineering Standards Association, on the grounds that the specification took no account of the average illumination of the roadway, but was based on a minimum illumination of a test point which in most cases is situated at the edge of the kerb, and that the classes defined by the specification did not necessarily represent the relative merits of the installations. This is what the authors of the paper under review have to say about the matter: "Our re-organization of the street lighting of South London and the development of highly directional systems of street lighting, with which we have been in keen competition in South London during this re-organization, suggest the necessity for a revision of the specification, in which the average illumination of the roadway shall be considered as at least equal, if not greater, in importance to a minimum illumination at a test point situated, in most cases, at the edge of the kerb." They exemplify mathematically why both test point and average illumination require to be taken into account in a specification of street lighting, as an increase of the former produced by an increase of mounting height must result in decreased average illumination of the roadway. It is shown that this matter of average, as contrasted with B.E.S.A. test point, illumination was of considerable importance in the illumination of the test mile of road in Lewisham, to which we have already referred.

Another important point made in the paper concerns the principle of fixed air and gas burners adopted by the South Metropolitan Gas Company, at the suggestion of Dr. Charles Carpenter, twenty-one years ago and adhered to ever since. The authors state that the half-hearted attempts which were formerly made to cope with changes in the composition and properties of gas by the provision of devices for the adjustment of the rate of supply of gas to the burner, and for controlling the induced primary air current, were never very successful. "Such devices are now quite unnecessary, as gas burners can once and for all be suitably designed, in the first place, for use with gas of the declared calorific value—that is to say, gas burners can now have as fixed and definite a construction as electric lamps." It is our opinion that the Gas Industry as a whole will come to share this view and adopt the fixed air and gas principle.

The 1931 Specification

THAT the criticisms of the 1927 B.E.S.A. Street Lighting Specification mentioned in the foregoing article were well founded is demonstrated by the revisions which have been made to the specification. These revisions form the subject of a paper at the Congress by the President, Mr. C. C. Paterson. Considering the practical results of the earlier specification—which he states has justified itself—Mr. Paterson remarks that it has not been possible entirely to prevent lighting authorities from giving exaggerated attention to the test point illumination to the exclusion of other factors which make for good lighting, with the object thereby of jockeying an installation into the next "class" of the specification, under the impression that the various classes represent an order of merit. Where minimum figures for mounting height have been given, there has been a tendency for these to be taken as heights which it is not worth while exceeding, whereas the B.E.S.A. Committee had hoped that in practice they would usually be exceeded. For many cases in which the lamp posts are on one side of the road only—in which event it is inherently difficult to produce a satisfactory installation—it has not been found that the prescribed minimum mounting heights are sufficient. In the revised specification the Committee has inserted, for each class, in addition to the old figure of minimum mounting height, a figure of recommended height; also, maximum values are laid down for the spacing-height ratios in the various classes.

On the vital point of average illumination, the Committee agreed that this should have some place in systems of classification of street lighting installations. It was considered, therefore, that the purchaser of an installation, besides knowing that it comes within the class he prescribes (on the basis of minimum illumination), should also know the average illumination; so that, if he has occasion to judge between two schemes for lighting a street within a particular class, he shall also have before him the figures of average illumination in the two cases. A requirement has therefore been inserted in the 1931 Specification that "with any tender there shall be given the value of the maximum and average illumination on the roadway. The average illumination to be calculated by a method to be agreed by the purchaser." As to the method, the specification recommends the use of the iso candle diagram. Another point to which we call attention is that in the 1931 Specification no numerical expression of glare has been used, though guidance is offered to users of the specification as to the means by which glare may be mitigated. Altogether the revised specification is a marked improvement on the earlier one.

Facts

A GUIDE to the gas lighting of London, Birmingham, Cambridge, Edinburgh, Glasgow, and Sheffield—this is the contribution of Sir Francis Goodenough to the Illumination Congress. When we say a "guide to the gas lighting," it is tantamount to a guide to the entire lighting of the cities and towns to be visited by the delegates of the Congress, with the exception of London; and even in the Capital gas is well holding its own, for there are over 96,000 gas lamps in use in the streets of London and its environs. In Birmingham, of the 666 miles of streets, 660 are lighted by gas; in Sheffield, 430 out of 501 miles of streets are similarly illuminated; in Glasgow, there are more than 26,000 gas lamps. Facts such as these must be made known. The public does not appreciate the part which the Gas Industry is playing in the street lighting of this country—that in England and Wales alone there are some 635,000 gas lamps, that this number

is increasing, and that enormous advance in efficiency has been effected during recent years. Gas, far from being a " back number " as an illuminant, is making progress as a modern lighting agent capable of satisfying modern conditions economically. The paper by Sir Francis Goodenough will, we are sure, not only provide a highly useful reference, but will be an " eye-opener " to many of the delegates—both from home and abroad—to the Congress. And it is only fitting here to offer a word of well-merited praise to the gas undertakings of the various cities and towns to be visited on the way in which they have successfully accomplished their task of demonstrating the effectiveness, efficiency, and future possibilities of gas as an illuminant. Our pages to-day contain many photographs which demonstrate clearly enough that gas is by no means behind the times.

Illuminate Accordingly

In a paper on the lighting requirements of different types of street (published in our issue to-day), Mr. J. F. Colquhoun and Mr. W. S. Stiles impressed upon the International Illumination Congress that the effectiveness of any lighting installation cannot be defined by reference to a stereotyped conception of what good lighting is, but is primarily concerned with particular requirements. The authors consider the performance of street lighting installations in regard to revealing power and attractiveness by night and by day; and they have a good deal to say on the subject of glare. The latter they divide into two categories—disability glare and discomfort glare. By disability glare they mean the depression of eye-sensitivity when one tries to look at an object situated close to a glaring light. By discomfort glare, on the other hand, they imply the unpleasant sensations which ensue when very bright sources of light or extended areas of high brightness are brought into the field of view. " Experiments show that, even though the measured disability glare in such a case may be relatively unimportant, yet this unpleasant sensation may still be very pronounced and must be taken into account. In a sense, discomfort glare has by definition nothing to do with revealing power, but it does indirectly play a part in determining the latter. If, by looking in a certain direction we subject ourselves to discomfort, we shall be reluctant to look in that direction; and although if we did so we should see objects, our reluctance to look reduces the probability of the objects being seen." The authors observe that disability glare depends first and foremost on the illumination produced at the eyes of the observer, that the nearer the light source to the direction of vision the greater the disability glare, and the higher the general level of brightness the less the disability glare.

Now the Gas Industry has always made a point that the low intrinsic brilliance of the gas mantle is in general in favour of gas lighting; and it is therefore of great interest to quote the following from the paper by Mr. Colquhoun and Mr. Stiles: " To reduce discomfort glare, the light source should be of relatively low brightness . . ." The authors carefully avoid any controversy in regard to the relative merits of gas and electricity for outdoor lighting, but those who study the paper must arrive at the conclusion that gas is well capable of fulfilling the requirements set out. We will confine our few comments to emphasizing the main findings as to the desiderata of the different classes of lighting dealt with in the paper. First in respect of arterial roads. Here revealing power is the sole consideration—in other words, one ought to strive at as high a brightness level as possible, some diversity, and freedom from disability and discomfort glare. Taking all these considerations *en bloc*, we suggest without humility that such gas lighting installations as those in Lewisham, which have been described and illustrated in our columns during recent months, are as good as any others which can be devised at the same cost. As to residential streets (not shopping centres), we require high revealing power and attractiveness; and the authors suggest that highly directional fittings are not desirable. In shopping centres and important city streets, " freed from the necessity of eking out his light to give maximum revealing power, the illuminating engineer can . . . choose fittings which give the most satisfactory appearance to the street both by day and by night." And we would remark that, though recently there has been considerable advance in the attractiveness of the design of gas lighting fittings, there is scope for improvement; it is a point to watch. Finally the authors have a few comments to make on spectacular lighting. " There is," they observe, " no limit to the various devices which can be employed in the lighting of promenades and show places generally." This limitless possibility applies to gas as well as to electricity. Those who may have previously thought otherwise must have had all doubts expelled last week when they saw the wonderful landscape lighting by gas in St. James' Park—a " veritable revelation," as we heard someone remark. In brief, the paper by Mr. Colquhoun and Mr. Stiles demonstrates that gas has no reason whatever to relinquish its firm and increasing hold on street and public lighting in this country.

Sane Expenditure

Lately the subject of economy has been as much in the public eye as was extravagance a short while ago, and the contents of the Daily Press make one realize the danger of the pendulum swinging as much too far in this direction as it did in the other. That the sort of Rake's Progress which the country has been making must be stopped has been evident for some time to all who could think; it is evident now to all who can read. The tale of Hogarth's immortal pictures is a sad one, but in the case of the nation the sacrifices will not have been entirely in vain if the hard lesson be remembered. The talk of economy must not be allowed to overshadow the cause of the trouble. No man could persevere in the course the country's finances have taken, and hope to escape the Bankruptcy Court; and even Governments must be subject to economic laws. " Equal sacrifices by all," as a slogan, may dim the fact that responsibility for the present crisis is not shared equally by all, but we must see to it that it does not obliterate the lesson.

We appeal for sane finance in the future, as we appeal for sane economy in the present. With the unemployment figures still mounting up towards the three million figure, it is not necessary to stress the urgency of this problem; yet day by day there appear in print suggestions, proposals, and schemes which can result only in further additions to the already alarmingly swollen ranks of the workless. From which course is the country likely to derive the greater benefit—the payment of men for the carrying out of desirable (and perhaps reproductive) works, or the payment of the same men for doing nothing? The Government themselves realize the danger of panic economy, which can but aggravate the ills they seek to lessen.

The goose (industry) that lays the golden eggs having been so nearly throttled, there is obvious fear in official quarters lest anything should be done to complete this disastrous tragedy. It should be pointed out that, while any increase of the stranglehold (taxation) might prove fatal, the poor bird can never really recover without some release of the present pressure. In other words, the country must not submit to the existing rate of taxation being regarded as other than abnormal. Not maintenance of this level, but sweeping reductions, must be the aim of any Government that is to merit the confidence of the electors.

PERSONAL

SIR FRANCIS GOODENOUGH, C.B.E.

An article in the "Co-Partners' Magazine" of the Gas Light and Coke Company, dealing with the career of Sir Francis Goodenough, thus concludes:

"The Chief Officers of the Company, together with the Station Engineers and other friends, gathered on July 30 to say farewell to Sir Francis, and presented him with a large pale yellow Chinese silk painting as a token of their esteem and regard. The presentation was made by the Secretary, and Sir Francis briefly replied. On the following day the Governor of the Company, at the conclusion of the meeting of the Court of Directors, presented Sir Francis, on their behalf, with a set of eight Chinese paintings on silk. In making the presentation, the Governor, in his speech, referred particularly to the ideal of service of which Sir Francis has always been an exponent—an ideal which he has very successfully implanted in all ranks of his Department.

"Although we believe that the series of presentations and the passing of farewell resolutions to Sir Francis has not by any means yet been completed, we must conclude this short article on his career by expressing our sense of the loss which the Company has sustained, which we trust will nevertheless be compensated for to some extent by his increased activities on behalf of the Gas Industry through the B.C.G.A. Sir Francis, we understand, is going to the States in the autumn to attend the Annual Meeting of the American Gas Association, and we trust that he will have a prosperous voyage and return in safety."

MR. AND MRS. C. S. SHAPLEY'S SILVER WEDDING.

A very pleasant ceremony took place at the offices of the Leeds Corporation Gas Department on Tuesday, Sept. 1, when Mr. and Mrs. C. S. Shapley were presented with a silver rose bowl by the senior members of the staff on the occasion of their silver wedding.

Mr. Shapley has been Engineer and General Manager of the Leeds Gas Department for thirteen years and has held several important offices in the Industry since coming to Leeds. He was President of the Association of Public Lighting Engineers in 1925-6, President for two years of the Manchester District Institution of Gas Engineers, in 1926 and 1927, and President of the Institution of Gas Engineers in 1930.

In making the presentation, Mr. C. H. Mitchell (Assistant Manager) voiced everyone's feelings when he said that Mr. and Mrs. Shapley had endeared themselves to all employed in the Department, and they were taking the opportunity on this memorable occasion to show their appreciation of the friendly relationship that had always existed. On behalf of the whole Department, he wished Mr. and Mrs. Shapley a continuance of a happy married life for many years to come and that they would both be blessed with good health. He also wished that the good feeling existing throughout would continue and ripen as the years rolled along.

The Chairman of the Gas Committee, Major Geoffrey H. Kitson, and the Deputy-Chairman, Alderman F. B. Simpson (The Lord Mayor designate), also spoke in appreciation.

At the request of the Council, the PRESIDENT OF THE INSTITUTION OF GAS ENGINEERS (Mr. J. Herbert Canning, O.B.E., F.C.S.) is attending the Annual Convention of the American Gas Association in Atlantic City, N.Y., from Oct. 12 to 16, prior to which he will visit the Canadian Gas Association in Toronto. The earliest opportunity has thus been taken of expressing the appreciation of the members of the Institution of Gas Engineers of the representation of the Canadian Gas Association and the American Gas Association at the First International Gas Conference and the 68th Annual General Meeting of the Institution of Gas Engineers in London in June last, when Mr. Clifford E. Paige, President, and Major Alexander Forward, Managing Director, personally attended the meetings on behalf of the American Gas Association. Mr. Canning leaves Southampton for Montreal on the s.s. "Alaunia" on Sept. 26, and will visit Ottawa, Toronto, Niagara, New York, and Atlantic City. He sails from New York on the s.s. "Lancastria" on Oct. 16, which arrives in England in time for him to preside at the 3rd Autumn Research Meeting of the Institution of Gas Engineers on Oct. 27 and 28.

Mr. SAMUEL DONALD, who was Manager of Dundee Corporation Tar Distillation Works until they were disposed of by the Corporation to a private firm, has received a new appointment with the Corporation. He is to test and blend the coal brought to the gas-works. The job is an experimental one.

Mr. J. J. SCOTT, Engineer and Manager of the Cowdenbeath Gas Company, has been appointed General Supervising Engineer to the British Electric Traction Company which recently took over this gas undertaking. As has been mentioned in the "JOURNAL" for Nov. 26, 1930, and for August 19 last, the British Electric Traction Company has now a wide interest in Scottish gas undertakings, other holdings acquired during the past year including Dalkeith, Gorebridge, Haddington, Loanhead, Penicuik, Tranent, and Prestonpans Companies.

Mr. TOBIAS HARRY TILLY, of West Hartlepool, who was Deputy Chairman of the Hartlepool Gas and Water Company, left estate of the gross value of £21,626.

Mr. H. L. ARMSTRONG has been appointed General Manager of the British Mannesmann Tube Company, Ltd., in succession to Mr. L. Hall, who has resigned after many years' service.

At a meeting last week of the Lord Provost's Committee of the Dundee Corporation it was decided to increase the salary of Mr. JAMES DICKSON, late Gas Manager, who is now Assistant Manager at the Corporation gas-works.

Mr. WALTER T. DUNN, M.I.Mech.E., formerly Secretary to the Institution of Gas Engineers, is serving this year as a member of the General Committee of the British Association for the Advancement of Science which will be holding its Centenary Meeting in London this month, under the Presidency of Gen. the Rt. Hon. J. C. Smuts, P.C., C.H., D.Sc., F.R.S.

Forthcoming Engagements.

Sept. 15.—INSTITUTION OF GAS ENGINEERS.—Meeting of Gas Education Executive Committee.

Sept. 15.—NATIONAL GAS COUNCIL.—Meeting of Central Executive Board at 28, Grosvenor Gardens, S.W. 1, at 3 p.m.

Sept. 15.—INSTITUTION OF GAS ENGINEERS.—Meetings of Finance Sub-Committee, 10 a.m.; Finance Committee, 10.30 a.m.; Executive Committee, 11 a.m.; Gas Education Committee, 4 p.m.; 28, Grosvenor Gardens, S.W. 1.

Sept. 15.—INSTITUTION OF GAS ENGINEERS.—Luncheon of the Council at the Shipping, Engineering, and Machinery Exhibition, Olympia, 1 p.m.

Sept. 15.—INSTITUTION OF GAS ENGINEERS.—Tea at the Shipping, Engineering, and Machinery Exhibition, Olympia, 4.30 p.m.

Sept. 15.—INSTITUTION OF GAS ENGINEERS.—Tea at Watson House for the Council, General Research Committee, and Joint Lighting Committee, 5 p.m., followed by inspection.

Sept. 15.—INSTITUTION OF GAS ENGINEERS.—London Illumination Tour, 8.15 p.m., 28, Grosvenor Gardens, S.W. 1.

Sept. 16.—BRITISH COMMERCIAL GAS ASSOCIATION.—Meetings of the Executive and General Committees at 11.30 a.m. and 2.30 p.m. respectively.

Sept. 17.—SOCIETY OF BRITISH GAS INDUSTRIES.—Council Meeting in the afternoon.

Sept. 17.—WALES AND MONMOUTHSHIRE ASSOCIATION.—Meeting at Porthcawl.

Sept. 23.—INSTITUTE OF FUEL.—Meeting at Burlington House. Paper by J. G. King and J. H. Jones on "The Reactivity of Coke. A Report to the Blast Furnace Committee Iron and Steel Industry Research Council."

Sept. 25.—INSTITUTION OF GAS ENGINEERS.—Meetings of Liquor Effluents and Ammonia Sub-Committee, 10.30 a.m.; General Research Committee, 2.15 p.m.; 28, Grosvenor Gardens, S.W. 1.

Sept. 28-30.—BRITISH COMMERCIAL GAS ASSOCIATION.—Annual Conference at Exeter.

Oct. 1.—INSTITUTION OF GAS ENGINEERS.—Meeting of Publications Committee, 2.15 p.m., 28, Grosvenor Gardens, S.W. 1.

Oct. 7.—INSTITUTE OF FUEL.—Joint Meeting with all those Institutions interested in the subject at the Institution of Electrical Engineers. Paper by Dr. W. R. Ormandy on "Coal: Smokeless Fuel and Oil from the National Standpoint."

Oct. 9.—MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.—Meeting in Preston.

Oct. 9.—NORTH OF ENGLAND ASSOCIATION.

Oct. 13.—INSTITUTION OF GAS ENGINEERS.—Meeting of Council, 10 a.m., 28, Grosvenor Gardens, S.W. 1.

Oct. 14.—EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.—Autumn Meeting in London.

Oct. 20.—SOUTHERN ASSOCIATION (EASTERN DISTRICT).—Meeting at 28, Grosvenor Gardens, S.W. 1, at 2.30 p.m.

Oct. 27-28.—INSTITUTION OF GAS ENGINEERS.—Autumnal Research Meeting.

THE NEWS OF THE WEEK

The Inspector of Bristol Gas Meters (Mr. E. H. Harney), in his report, states that during the past quarter 2413 meters were tested. Of these 2027 were correct and 386 incorrect.

An Interim Dividend has been declared by the Directors of the Peterborough Gas Company at the rate of 5 p.ct. per annum on the new preference shares and 7½ p.ct. per annum on the consolidated ordinary stock.

The Bristol Gas Company are again exhibiting at the Annual Exhibition at the Colston Hall between Sept. 3 and 16. A wide range of up-to-date gas appliances will be on view. Gas Company officials are in attendance to give advice throughout the period of the exhibition.

Courses in Applied Chemistry, and also fuels, electro-plating, and metallurgy, commence at the Northampton Polytechnic, St. John Street, E.C. 1, on Monday, Sept. 21. Particulars and prospectus may be obtained upon application to the Principal, Mr. S. C. Laws, M.A., M.Sc. Enrolments will be taken during the week commencing Sept. 14.

The Manchester District Institution of Gas Engineers will hold their next meeting in Preston on Oct. 9, when the new works of the Preston Gas Company will be visited, followed by the general business meeting and the adjourned discussion on the papers on "Dilution of Straight Coal Gas" submitted at the meeting held in Stretford on July 3 last.

A Modern Homes and Health Exhibition is to be held in the Millbay Drill Hall, Plymouth, during the ten days commencing Wednesday, Oct. 14. In addition to the stands of firms of national repute, the Plymouth Public Health Department and twelve municipal institutions have taken spaces. Lectures are to be given daily by prominent personages, in connection with which films will be shown. The Plymouth Education Department is arranging for 5000 children from the various schools in the city to visit the exhibition.

A Fire which broke out on the night of Aug. 28 at the shoddy works of Marshall Bros., Green Street Mills, Ravensthorpe, gave rise to a serious threat to the premises of the Mirfield Gas Company. Only a brick wall separated the two premises, and flames actually spread to the roof of the gas purifying plant, some 35 ft. of this roof catching fire. Employees of the gas-works formed themselves into a human chain and checked the outbreak on their own premises by buckets of water, while the Dewsbury Fire Brigade got the main outbreak under control.

The Association Technique de l'Industrie du Gaz en France announced that in conjunction with their annual congress in 1932 they are organizing two competitions in connection with which prizes totalling about £240 are being offered. The first competition is for improved appliances for use in connection with the manufacture and distribution of gas, while the second is for improved apparatus for the use of gas and particularly that intended for cooking in large establishments and for industrial purposes. Entries for the competition close on Dec. 31 next, and particulars may be obtained from the Association at 21, Rue Blanche, Paris.

The Langley Mill and Heanor Gas Light and Coke Company, in their report for the year ended June 30, state that the amount realized for gas and meter and stove rent during the year is £25,791, against £24,583 during the previous year. Residuals show a decrease of £780 as compared with last year's receipts. After deducting dividends paid on Sept. 1, 1930, and on March 1, 1931, and transferring the sum of £400 to reserve fund, the profit and loss account shows an available balance of £10,296, out of which the Directors recommend that a further dividend of 6s. per share be paid on the "B" shares, 4s. 6d. per share on the "C" shares, making 12 p.ct. and 9 p.ct. respectively for the year, and 2s. 6d. per share on the "A" preference shares, and 3s. per share on the "D" 6 p.ct. preference shares, less income-tax, that the sum of £90 be transferred to reserve fund, and the balance be carried forward to next year's account.

The Union of Swedish Gas-Works in Stockholm have lately issued a report stating that there were 37 gas undertakings in Sweden at the end of 1929. The total production of gas in the country during the year amounted to 5,653,824,000 c.ft. as compared with only 5,294,470,000 c.ft. in 1928, an increase of about 6·75 p.ct.

Gas Production in Switzerland.—According to a report lately issued by the Swiss Gas and Water Engineers' Association in which eighty-one gas-works are represented the present year has so far witnessed a further increase in the consumption of gas in Switzerland, despite the fact that the works in some of the industrial areas have experienced a slight set back. Thus the report states that the output of gas by the eighty-one works during the first half of the current year attained a total of 5069 million c.ft.—an increase of about 3·9 p.ct. over the corresponding six months of 1930.

South Australian Gas Company.—The report of the Directors for the year ended June 30, 1931, shows a profit (before providing for special purposes fund) after paying interest on bonds, and adding the balance of £2398, carried forward from last year, of £93,354. This has been applied in the following manner: Dividend for half-year ended Dec. 31, 1930, at the rate of 5 p.ct. per annum, £35,000; dividend for half-year ended June 30, 1931, at the rate of 5 p.ct. per annum, £35,000; transferred to special purposes fund, £20,956; balance to be carried forward in profit and loss account, £2398.

Insurances for Gas Undertakings.

Our advertisement pages contain a notice in the above connection which should be of considerable interest to the Gas Industry.

Third-party insurance for gas undertakings is by no means new, but every year accidents followed by serious injury to persons or property result in heavy indemnities being awarded against gas undertakings. There is therefore an increasing necessity for a form of cover which shall include liability arising from explosions in the street and in the home, and accidents arising from negligence of the gas undertakings' employees. The Norwich Union, whose name is synonymous with security, offers such a policy.

A form of insurance which is definitely new is concerned with gasholders. During the last two years gas undertakings have come under the notice of the Chief Inspector for Factories, who has drawn attention to the need for periodical inspection of gasholders by competent engineers. The Norwich Union offers at reasonable charges to provide periodical inspection under the care of an eminent gas consultant and also valuable insurance protection. The Norwich Union plan has the inestimable advantage of being adaptable to the particular needs of individual gas undertakings and varies from a very full form of cover to a policy which merely provides inspections and indemnifies the gas undertaking against damage to the gasholder itself.

Potential Investments.

Wandsworth and Commercial Companies.

The "Financial Times" recently featured the Wandsworth and District Gas Company in their "potential investments" column, drawing attention to the fact that, having regard to the successive reductions in price and unfavourable external influences, the recent dividend distribution of 2 p.ct. above the basic rate of 5 p.ct. is a laudable and encouraging achievement.

The Company, it was mentioned, was incorporated in 1912 as an amalgamation of the old-established Wandsworth and Putney, Mitcham and Wimbledon, and Epsom and Ewell undertakings. As from July 1, 1930, the Kingston-upon-Thames Gas Company was acquired, while in January of this year a provisional agreement was entered into for the absorption of the Sutton Gas Company.

Excluding the Sutton district, the area of supply is 65 square miles, embracing densely populated metropolitan

boroughs and that important South-West London corridor extending many miles along the Surrey side of the Thames Valley. Thus the Company's business has undergone continual rapid development and promises further considerable expansion as the development of these areas proceeds.

It has been the definite policy of the Board, laid down long ago, to sell gas as cheaply as possible consistent with giving an abundant and efficient supply, and, under the provisions of the Companies Acts, the price of gas in the various districts has been steadily reduced from time to time by virtue of a careful control over expenditure.

COMMERCIAL GAS COMPANY.

A subsequent edition devoted attention to the Commercial Gas Company, which, it was stated, was established as long ago as 1839, incorporated by a special Act in 1847, and re-incorporated in 1852. The statutory area of supply covers about seven square miles, comprising the metropolitan boroughs of Stepney and Poplar and parts of Hackney, Shoreditch, Bethnal Green, and the County Borough of West Ham, a very important manufacturing, trading, and residential area in close proximity to the City.

In September last sanction was accorded by the Board of Trade to certain working arrangements with the South Metropolitan Gas Company, which have already led to a highly beneficial co-operation of the activities of the two undertakings.

The Company's reserve fund stands at £73,624, and the special purposes fund at £44,803. The sum invested was £77,991 and actual cash amounted to £12,832.

Sir John Cass Technical Institute.

The new session of the Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C. 3, which extends over about 36 weeks, will begin on Monday, Sept. 21, and students will be enrolled during the preceding week.

The Institute provides instruction in pure and applied mathematics, physics, chemistry, botany, zoology, biochemistry of fermentation (including malting and brewing), petroleum technology, fuel technology (including coal carbonization and gas manufacture), metallurgy, assaying, geology, modern languages, arts and crafts, and tailoring. The science courses are arranged to meet the requirements of those engaged in chemical, metallurgical, electrical, petroleum, and fermentation industries, and are held from 6 to 10 p.m.

Full facilities are provided in well-equipped laboratories for special investigations and research. The instruction in experimental science also provides systematic courses for the examinations of London University, the Institute of Chemistry, and the Institute of Brewing.

The Principal or heads of departments will be pleased to advise intending students at the commencement of the session on the course they should undertake.

Hastings Company's Co-Partners' Social Club.

A Wide Range of Activities.

The Hastings and St. Leonards Gas Company's Co-Partners' Social Club has only been in existence since March, but already it has become firmly established and is now flourishing. The winter session commences in September, when there will be a women's section for needlework and cookery classes, choral section, whist drives, dances, and it is hoped to form a concert party.

Among its numerous activities, horticulture is one of the most utilitarian and one of the best supported. Undaunted by this year's bad gardening weather, the horticultural section held its first show in the Board Room on Aug. 28.

It was opened by Mr. A. M. Apel (Chairman of the Gas Company and President of the Club). He congratulated competitors on their efforts, remarking that until they had more experience in holding shows it would be better to keep to only a few classes. "It is these little social events that help to make life worth living," he added.

A vote of thanks to Mr. Apel was proposed by Mr. C. F. Botley (General Manager).

There were only a few classes, but the exhibits were of a very high standard. Thirty-six competitors took part, providing about 60 displays. One of the most important classes was the cooking, a fine array of cakes and bread being exhibited by numerous ladies. Perhaps the potato competition aroused the most interest. Each competitor was given three tubers to be divided into not more than six sets. The prize, given by Mr. A. Coote, was won by Mr. H. Stonham, with 24 lbs. of potatoes.

Among the many visitors who also admired the produce were Councillor Arthur Thorpe, J.P., and Mr. H. H. Moppett (Directors), and many other officials of the Gas Company.

During the afternoon music was played by the Co-Partners' "Radiation" Dance Band under Mr. A. Bevis.

The prizes were distributed in the evening by Mrs. Apel, who congratulated the exhibitors on their efforts. Votes of thanks were accorded the judges, committee, and donors of prizes, and the evening concluded with a Dutch auction of the produce by Mr. A. G. Taylor.

British Commercial Gas Association.

Programme of Annual Meeting, Sept. 28, 29, and 30.

The following programme has been arranged for the Twentieth Annual General Meeting and Conference of the British Commercial Gas Association, to be held at Exeter on Monday, Tuesday, and Wednesday, Sept. 28, 29, and 30, under the Presidency of Mr. John E. Daw, J.P., Chairman of the Exeter Gaslight and Coke Company.

Monday, Sept. 28.

AFTERNOON AND EVENING.

Inaugural Meetings.

4.30 p.m. Reception by the Mayor and Mayoress of Exeter at the Guildhall, after which tea will be served.

8. o to 8.30 p.m. Reception by the President at the Civic Hall.

8.30 p.m. Lecture by Sir Banister Fletcher, F.S.A., F.R.I.B.A., Past-President of the Royal Institute of British Architects, on "Architecture as a Democratic Art."

The vote of thanks will be proposed by Mr. H. Austen Hall, F.R.I.B.A., Consulting Architect to the Association.

9.30 to 10.30 p.m. Music and refreshments.

Evening dress. Decorations will be worn.

Tuesday, Sept. 29.

MORNING.

Business Conference.

Private Session.

10.15 a.m. Assembly of members in the Assembly Room, Rougemont Hotel.

Presentation of annual report and statement of accounts by the Executive Chairman, Sir Francis Goodenough, C.B.E.

Public Conference.

Presidential Address by Mr. John E. Daw, J.P., Chairman of the Exeter Gaslight and Coke Company.

Paper by Dr. Meredith Davies, M.D., B.Ch. (Oxon.), D.P.H. (Oxon.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), County Medical Officer for the County of Devon, on "Public Health and the Gas Industry."

Followed by discussion.

Address by Sir Leonard Hill, M.B., LL.D., F.R.S., Supervisor of the London Light and Electrical Clinic, on "Gas as a Source of Radiant Energy for Treatment of Disease."

Followed by a communication from Mr. H. J. Taylor, Ph.D., B.Sc., Physicist, The London Light and Electrical Clinic.

Followed by discussion.

12.30 p.m. Adjournment.

AFTERNOON.

2.30 p.m. Visits to places of interest:
(1) The Guildhall and the Cathedral.
(2) The Gas-Works and Showrooms.

EVENING.

7.15 for 7.30 p.m. Dinner by invitation of the Chairman and Directors of the Exeter Gaslight and Coke Company, at the Civic Hall.

Evening dress. Decorations will be worn.

Wednesday, Sept. 30.

MORNING.

Business Conference.

10. o a.m. Assembly of members in the Assembly Room, Rougemont Hotel.

Public Session.

Paper by Mr. W. N. Westlake, M.Inst.Gas E., Engineer and General Manager, Exeter Gaslight and Coke Company, on "Business Building."

Paper by Mr. Stephen Lacey, B.Sc., M.Inst.C.E., M.Inst.Gas E., Controller of Gas Sales, Gas Light and Coke Company, London, on "The Reinforcement of a Gas Sales Organization by Research and Training."

Followed by discussion.

Private Session.

Discussion on Mr. Harold Whitehead's Confidential Report to the Executive Committee of the Association on his Survey of Selling and Service Methods in the Gas Industry.

12.30 p.m. Adjournment.

1. o p.m. Luncheon at the Civic Hall by invitation of the President-Elect, the Vice-Presidents, and Members of the Association, to the retiring President and the Directors of the Exeter Gaslight and Coke Company.

Close of Conference.

THE NEWS—continued.

The Crisis and the British Industries Fair.

A side-light on the national crisis is contained in a statement made last week by Mr. C. Elliott, General Manager of the British Industries Fair, Birmingham.

"The usual lull in the booking of space at the time of August Bank Holiday continued during the next three weeks," said Mr. Elliott, "and at the height of the economy crisis a few firms actually withdrew their applications.

"Then on Aug. 24, when a settlement was announced, there began one of the best weeks in the history of the Fair in Birmingham. The space booked during the week amounted to over 10,000 sq. ft., with the result that 200,000 sq. ft. in all is now definitely booked, leaving unlet only about 40,000 sq. ft., of which a large amount is provisionally reserved.

"While the majority of the bookings are by firms which have exhibited for many years, a notable feature is the return of old exhibitors who have been missing recently. Their return, I think, is a sign of appreciation of the great improvements made in the Fair in Birmingham since they last exhibited. There are also a number of new exhibitors, both in the old sections and in those which have been formed this year."

The Birmingham section of the Fair opens on Feb. 22 and closes on March 4.

Notes from Scotland.

A Dividend of 5 p.ct. has been paid by Pitlochry Gaslight Company, free of tax.

It Was Agreed at a recent meeting of Perth Town Council to reduce the price of gas by a penny per 1000 c.ft.

The Peebles Town Council have received word from the Unemployment Grants Committee that a grant is to be given for the erection of an additional holder at their gas-works.

Price Reductions in Scotland.—The Port-Glasgow Town Council have reduced the price of gas by 3d. per 1000 c.ft. Gourock is to reduce the price by 2d. per 1000, while Dunoon is considering a reduction by 3d. Inverbie has had its gas reduced by no less than 10d. per 1000, making it now 9s. 2d. per 1000. Anstruther and Cellardyke Gas Company have taken off 2½d.

The Dundee Town Council have considered an application from their Gas Manager, Mr. J. Wilson, for a supplementary grant of £2000 for additional equipment for the gas-works. The new plant is to consist of a duplicate telpher carriage and coke-grab, telpher rest-house, turning lathe and screening machine for engineering shops and oxide disintegrator, and coke screening and grading plant. It was left to Mr. Wilson to report at the next meeting.

The National Task.

Sir J. Ferguson Bell writes to "The Times" for Sept. 7:

Your numerous readers will no doubt read with satisfaction the leading article in "The Times" to-day (Sept. 5) on "The National Task."

I venture to state a large number of the electors do not desire a General Election before next spring at the earliest. Mr. MacDonald and his colleagues, who have had the courage to place their country before party dogma, will have more than enough fully to occupy their activities, without the turmoil of an election. The new National Government comprises eminent statesmen representing all three parties. A General Election is not likely to give us a stronger Government to deal with the formidable tasks confronting the country.

For several years past we have had too much politics, alluring promises of improved trade and industry, with colossal expenditure both national and local, much more than the country can afford, with the result that ruin and disaster stare us in the face. Instead of this new National Government being distracted and confused by an appeal to the country, it would be wiser to allow them time to complete their responsible self-imposed task to bring back some measure of prosperity to our sorely tried country and confidence in the future. Time is necessary to allow the proposed economies to take effect, and the people to realize the true position of affairs.

Dinner and Dance of the Institute of Fuel.

The Annual Dinner and Dance of the Institute of Fuel will be held at the Connaught Rooms, Great Queen Street, W.C. 2, on Wednesday, Oct. 21, at which the President, Sir Hugo Hirst, Bt., will preside. The President and Lady Hirst will receive the members and guests at 6.45 p.m., and dinner will be served at 7.15 p.m.

A large number of distinguished guests will be present, and the toast of "The Fuel Industries" will be proposed by the Rt. Hon. Sir Robert Horne, G.B.E., and responded to by the President. The dinner will be followed by a dance, and a cabaret performance will be given in the Banqueting Hall from 11 to 11.30 p.m., after which dancing will be continued until 1.30 a.m.

Mr. Ernest Rutterford's Band will play during dinner and for the dance in the banqueting hall as soon as it has been cleared for the purpose; but immediately following the conclusion of the speeches (about 10 p.m.) dancing will first commence in the Reception Room, where another band will be in attendance and will play for dancing until 11 p.m.

The price of tickets, exclusive of wines, but including light refreshments during the dance, will be one guinea each.

LANDSCAPE LIGHTING BY GAS IN ST. JAMES'S PARK.

International Illumination Congress, 1931

The Meeting is divided into two parts, the first part consisting of a Congress from Sept. 2 to Sept. 12, and the second part of meetings of the Technical Committees of the International Commission on Illumination from Sept. 13 to Sept. 19

NOTES ON THE PROCEEDINGS IN LONDON

A snapshot taken in Whitehall at night without flashlight. It is a splendid example of high-pressure gas lighting. The illumination is above Class A standard of the B.E.S.A. Specification for Street Lighting.

OFFICIAL LUNCHEON.

The programme of visits in London, with which the Congress opened—the business sessions did not start until Glasgow was reached, late in the week—was an extensive one. It began on Tuesday morning with inspections of the Kensington showrooms of the Gas Light and Coke Company and the E.L.M.A. Lighting Service Bureau.

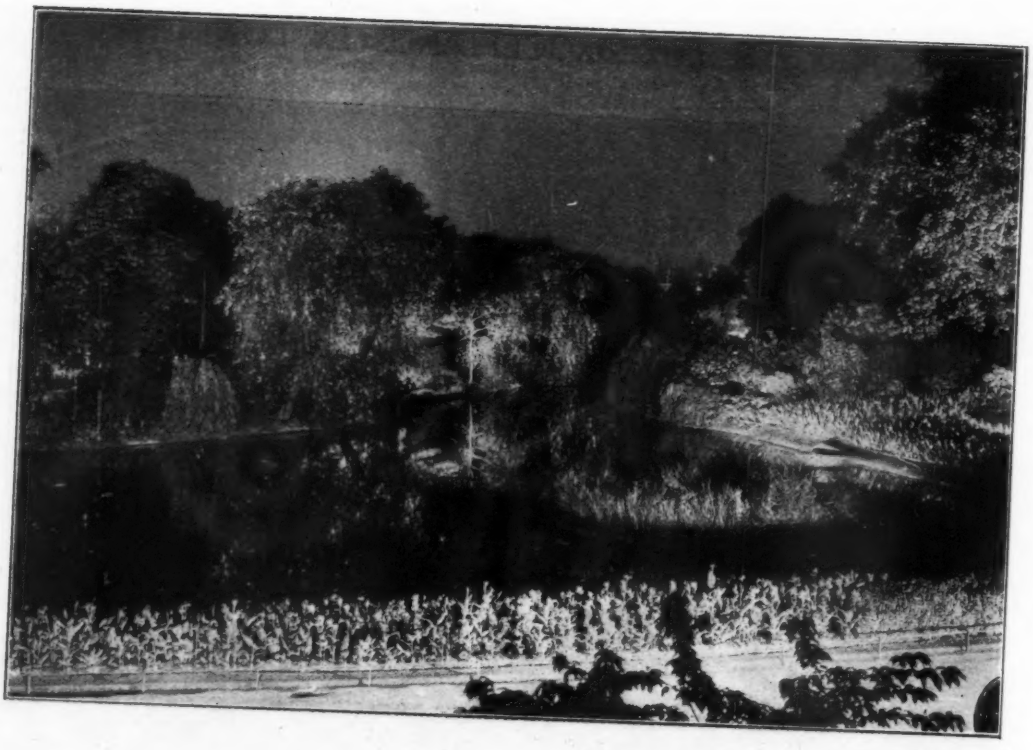
The Inaugural Luncheon at the Savoy Hotel—Lieut.-Col. Kenelm Edgcumbe, R.E. (T.), Chairman of the General Council of the Congress, presiding—followed, and was very largely attended. An address of welcome by the Chairman to visitors was given in English, French, and German; and the Gas Light and Coke Company and the London Electric Supply Undertakings—by whom the invitations had been issued—were heartily thanked for their hospitality, as was Mr. Peter Good (Chairman of the London Local Committee) for the arrangements made. The welcome was feelingly acknowledged by M. A. Filliol (Switzerland), Hon. Treasurer of the International Commission on Illumination, who expressed his gratification at the fact that the Congress was meeting in the United Kingdom, where there had been so many contributions to the advancement of the science of illumination.

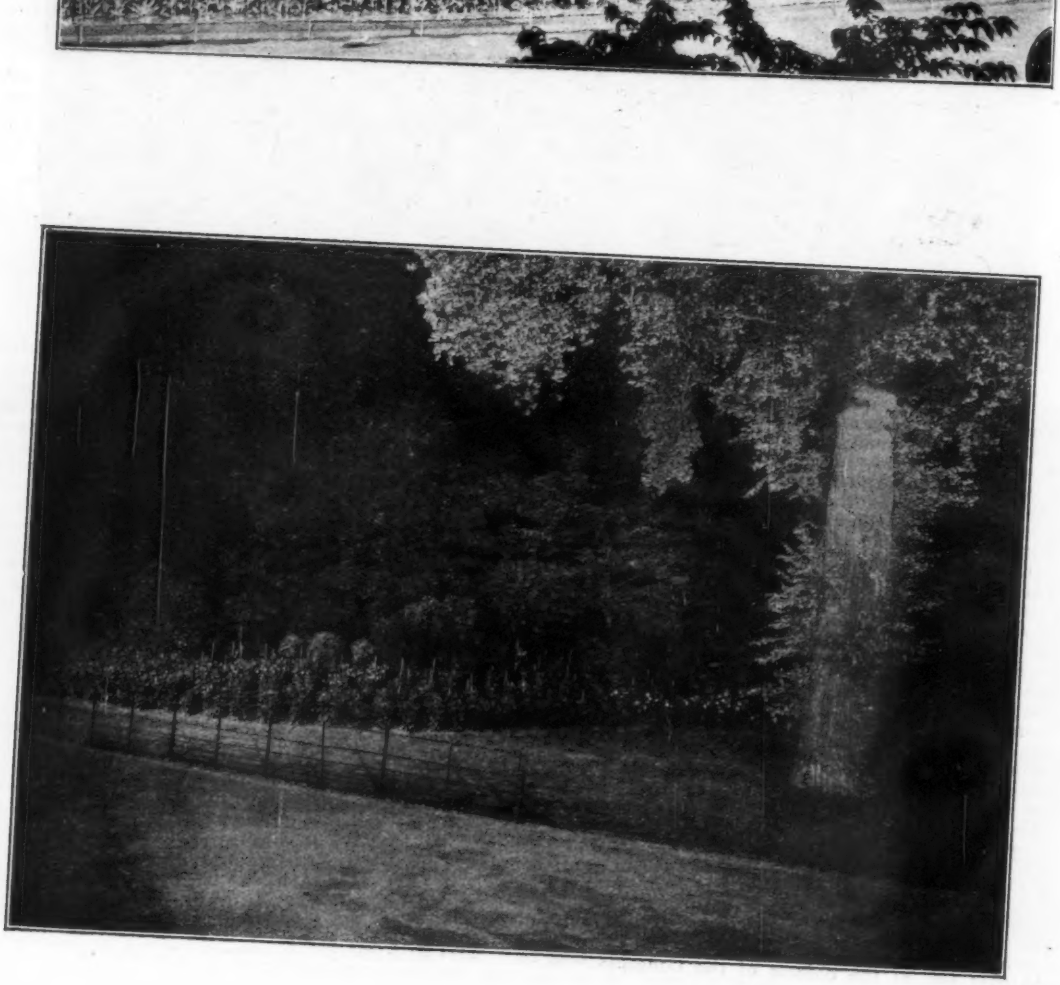
Mr. George Lansbury on Light.

The Right Hon. George Lansbury, M.P. (late H.M. First Commissioner of Works), then submitted, in a characteristic speech, "The International Illumination Congress." He said that one of the objects of the Congress was to make better known the uses of gas and electricity in a thousand-and-one ways, and thereby increase both expenditure and consumption. [Laughter.] Those present represented the International Commission on Illumination set up thirty years ago. During the intervening years those associated with the task of lighting the dark places of the earth had done much to spread the light by pooling their knowledge and by constant co-operation and conference. He believed that the only true law of progress was by conference and co-operation. He trusted that in the great task of serving the nations of the world both gas and electricity would become more and more the servants of all in every department of human affairs, and that the Congress would show them how to bring more light into every village, into every street, and into every home. The floodlighting would enable people to see what London could be made to look like at night.

After lunch there was a programme of river visits which concluded late at night with an inspection of the illuminations. An account of this portion of the day's proceedings will be found in an Editorial Note on an earlier page, and here it will suffice to say that one of the places inspected was the Beckton works of the Gas Light and Coke Company. Mr. George Lansbury was among the party who went there, and he and Mr. Clifford C. Paterson were conducted round by Mr. R. W. Hunter, the Station Engineer. Mr. Stephen Lacey (Controller of Gas Sales) was also with the party.

Views of St. James's Park Illuminated by the Gas Light and Coke Company





OFFICIAL BANQUET

A Brilliant Function

The Official Banquet took place at the Dorchester Hotel, Park Lane, W., and was a brilliant and largely attended function. The speeches were few and to the point, and there was a well selected programme of music. Afterwards some of those present proceeded to witness an exhibition of aerodrome and aircraft lighting at Croydon, while others went on a tour of London to see store lighting, street lighting, and floodlighting—the route selected embracing Kensington High Street, Kensington Road, Knightsbridge, Hyde Park Corner, Park Lane, Marble Arch, Oxford Street, Regent Street, Piccadilly, Constitution Hill, The Mall, Admiralty Arch, Trafalgar Square, Strand, Fleet Street, Ludgate Hill, St. Paul's Cathedral (inspection of interior lighting), Cannon Street, Queen Victoria Street, Cheapside, Newgate Street, Holborn, Oxford Street, Bayswater Road, Kensington High Street.

The chair at the banquet was occupied by Mr. Clifford C. Paterson, President of the International Commission on Illumination, who proposed the Loyal Toasts. The only other toast was that of "The International Illumination Congress."

The CHAIRMAN, calling upon the proposer of this toast, said he thought that already the congress had become memorable, and it should prove a great stimulus to progress. It would help everyone to realize how much more scientific illumination could do for civilization, how much more it could do for modern industry, and how much more it could do for domestic comfort, than it had done in the past. He emphasized the fact that none of the cost of the public illuminations was defrayed from public funds.

EDUCATE THE PUBLIC.

Sir HUGO HIRST, Bart., Chairman of the General Electric Company, Ltd., in asking those present to drink to the success of the congress, remarked that it was, he believed, the first occasion on which the congress had met in the United Kingdom. Floodlighting had been adopted as a sign of welcome to the foreign delegates, and he hoped they would find it up to any standards to which they had been accustomed. He thought they would agree that the present illumination of London proved that, despite the vagaries of this climate, the British gas and electricity industries were aiming at the very highest standard in their lighting systems. Those present were aware of the good work that the illuminating engineer was doing, but unfortunately the public did not know of it. Some 30 years ago, when the movement was started, their aims were very modest. They concentrated on creating standards and selecting nomenclature. These things, although they might have meant nothing to the lay mind, laid the foundations of the science as it existed to-day. They had devoted great attention to factory and street lighting, as well as to illumination in the home. One of their objects must be to educate the public to require greater illumination, and in this connection it was necessary to enlist the sympathy of the architect. Too frequently it happened that the illuminating engineer was called in for advice after a building was constructed, whereas lighting and architecture ought to go hand in hand. Illumination was really still in a state of evolution. They did not know what science might have in store for them. The illuminating engineer was accomplishing a great work, and the public owed those engaged in this work a deep debt of gratitude. Better lighting meant better homes, more efficient works, and improved health. It also meant greater safety on the roads, less crime, more cheerfulness, and increased happiness all round.

Mr. HENRY WOODALL, Deputy-Governor of the Gas Light and Coke Company, said that Sir David Milne-Watson had been chosen to support this toast, but unfortunately he had been called away to the Continent, and so had asked him (Mr. Woodall) to carry out this pleasant duty, which he would so much have liked to undertake himself. Sir David had, however, sent the following message:

SIR DAVID MILNE-WATSON'S MESSAGE.

> I am asking Mr. Woodall to express to you my great regret that I have been unavoidably prevented from meeting the delegates—and particularly the foreign delegates—who have gathered in London to consider at this important congress the improvements in the science and art of illumination which have taken place in the past few years.
>
> It is particularly pleasing to me that the representatives of the great gas and electricity industries should meet to discuss the results of recent research on the better lighting of our cities, and I wish the congress every success.

MR. HENRY WOODALL ON THE PROGRESS OF GAS LIGHTING.

Proceeding, Mr. Woodall said: Illumination is of very ancient date. In fact, it begins with the Creation. We learn that, on the fourth day, the Great Architect of the Universe made "two great lights, the greater light to rule the day, and the lesser light to rule the night." From that time until now it has been of increasing importance to provide the illumination necessary to carry on the complex work of civilization and to reinforce the two Great Lights. Many of us here are engineers, and you remember the definition of the profession of a civil engineer—the art of directing the great sources of power in Nature for the use and convenience of man. I think, ladies and gentlemen, that we who are engaged in the art and science of Illumination may reasonably feel that we are carrying out the great aim I have just quoted. I always have a little sympathy with the old lady who said that she liked the moon better than the sun, because it shone when it was wanted. If that old lady could be with us to-night, she might well give the preference to *our* lights, which shine not only when but where they are wanted.

At the moment when economy is everyone's watchword, I have heard some criticisms of the cost of our Illumination Congress. I should like at once to point out that the cost of the congress and of the illumination is being borne by the electrical and gas industries. It must also be remembered that it is only by meeting together, by experiment and illustration, that we can learn the most economical and efficient ways of carrying out our most important duties.

With regard to the lighting we shall see to-night. In our great city of London there are many almost unknown gems of architecture, but, when they are singled out by illumination, vast numbers of people will see and appreciate the beauties of their city as they have never done before. I think we shall agree that, once realizing the wonderful possibilities of floodlighting, we might well be called wasteful of great opportunities if we did not take the advantages it provides. Great strides have been made in lighting in the past few years. Interiors have been illuminated more effectively by the dazzling—I should, of course, say the brilliant—lighting of our electrical friends. In street and factory, and in other ways, gas lighting has held its own. You will see to-night some very effective illumination. I know a number of European Capitals, and I think it can be claimed that some of the lighting in London cannot be beaten anywhere in the world.

I well remember, some fifty years ago, the introduction of electric light. My late father was at that time Engineer of the old Phœnix Gas Company, later taken over by the South Metropolitan Company, and I recollect clearly being taken to see improved street-lighting provided to show what could be done by gas. It was necessary then to use 40 c.ft. of gas to obtain 100 candle power. Later, in 1886, when the Welsbach lamp was introduced, the 100 candle power was obtained for 6·02 c.ft. Again, there is high power low-pressure gas, which only requires 4 c.ft. per 100 candles. And, lastly, we have high-pressure burners, where the quantity of gas is brought down to 2 c.ft. per 100 candles. So that gas for lighting can now be obtained for one-twentieth of what it would have cost fifty years ago. I have no doubt that figures showing the reduction in the cost of electricity are also equally startling.

Speaking as Deputy-Governor of the Gas Light and Coke Company, I may say we have regarded the congress as an opportunity of contributing to the general welfare of the lighting industry. With this in view, London's perhaps most historic thoroughfare, Whitehall, has been specially illuminated. You will, I am sure, consider this lighting highly efficient, and something to aim at as a standard. The Company have also carried out the somewhat difficult task of illuminating, by specially designed lamps, considerable areas in St. James's Park, with results which I think you will find both interesting and attractive.

COMPLEMENTS—NOT RIVALS.

In conclusion, may I suggest that electricians and gas men should work a little more together, and perhaps in time we might regard ourselves as complements one of another, rather than as serious rivals. I am closely connected with two undertakings supplying both gas and electricity, and in these cases I am convinced that it is to the advantage of the consumer to have one undertaking supplying both forms of light, heat, and power, rather than competing companies. This is neither the time nor the place to discuss combination of our interests, but it is worth consideration—as we can all recall numbers of cases of wasteful and unnecessary expenditure which would have been avoided had economy and the public good been the main object.

We all welcome this opportunity of meeting and discussion, and I am satisfied the result will be a better understanding, and in consequence we shall develop a sound policy on the most important question of the best means of illuminating our cities and our dwellings. May our light so shine that deeds of darkness may be fewer, and may we so illuminate many known, as well as many now hidden, beauties that we may earn the thanks and gratitude of our fellow men and women.

Responses were made by M. DE VALBREUZE (France), Herr W. WISSMANN (Germany), and Dr. E. C. CRITTENDEN (United States).

A VIEW OF THE CENOTAPH UNDER THE DEMONSTRATION LIGHTING.

Gas Floodlighting at Rotherham.

Rotherham's contribution to the floodlighting campaign initiated by the holding of the Illumination Congress in this country has lately included experimental floodlighting by electricity of the Parish Church; but on Sept. 3 the Rotherham Hospital and grounds were floodlighted by gas on the occasion of the opening of a new £20,000 extension by the Countess Fitzwilliam. The chief units employed in the lighting—which was carried out by Rotherham Corporation Gas Department—were three 16-light and six 12-light strip lanterns with reflectors, the 16-light lanterns being equivalent to 1500 candle-power each.

Papers in Conjunction with the Association of Public Lighting Engineers.

Our later pages this week comprise the majority of the gas papers presented in Edinburgh on Monday last, when the Congress was merged with the Annual Meeting of the Association of Public Lighting Engineers.

Demonstration Lighting at Whitehall

A "Class A" Thoroughfare

The Gas Light and Coke Company considered that a fresh impetus might be given to the cause of good highway lighting if an important London thoroughfare was illuminated to conform with the Class A requirement of the B.E.S.A. Specification for Street Lighting. Although it is believed that the class of lighting existing in Whitehall prior to the Illumination Congress was giving every satisfaction, the demonstration is designed to enable the members to gain a first-hand impression of a Class A street. It was not possible to change the position of any of the existing units; all that could be done in regard to spacing was to arrange the position of the new units to the best advantage. In consequence, the spacing-height ratio is not as uniform as could be desired. Moreover, Whitehall is not of uniform width, a fact which increases the difficulty of obtaining uniform illumination. The modification has involved the provision of twelve new units. In addition, the height of each column has been increased to bring the light centre of the three lamps, which are now carried on an ornamental bracket, to approximately 30 ft. This is the lowest height recommended for a Class A street in the 1931 Specification. The centre lamp has a rated candle power of 4500 candles, and the lamps on either side have rated candle powers of 3000.

The lamps were made by Messrs. James Keith & Blackman Co., Ltd., and are similar in design to those used in many of the more important thoroughfares in London and the provinces.

The gas is supplied to the lamp at approximately 100-120 in. (254-305 cm.) water gauge. With a pressure of this magnitude all the air necessary for the combustion of the gas can be entrained at the injector. This results in a higher flame temperature than can be obtained with low-pressure gas, and in consequence a higher lighting efficiency is obtained. The mixture passes along the bunsen tube and enters a preheater, where its temperature is raised and the air and gas thoroughly mixed.

Before the modifications were commenced a complete isolux diagram for the new system was calculated.

Table I. gives details of the new system of lighting; similar facts for the older system are included, and this enables a ready comparison.

WHITEHALL AS A "CLASS A" THOROUGHFARE.

TABLE I.

Ref.	—	Demonstration System (Calculated allowing 15 P.Ct. Depreciation from Rated Value).	Original System. (Actual Measurement).
1	Number of units	29	18*
2	Length of road (King Charles Street to Horse Guards Avenue)	940 ft. = 287 metres	940 ft. = 287 metres
3	Height of centre lamp of unit	29·25 ft. = 8·9 metres	21 ft. = 6·4 metres (one lamp only)
4	Spacing height ratio = $\frac{\text{Columns 2}}{\text{Columns 1} \times 3}$	1·1	2·5
5	Candle power (as defined) (Average 70°–90° to vertical)	8900 candles	2550 candles
6	Average illumination	5·9 foot candles = 63 lux	1·4† foot candles = 15 lux
7	Mean test point illumination	4·1 foot candles = 44 lux (Average of 13 test points)	0·41 = 4·4 lux (Average of 5 test points)
8	Class as defined by B.E.S.A. Specification, 1931, Table I.	A	C
9	Maximum illumination	8·7 foot candles = 93 lux (Average of 12 points)	3·8 foot candles = 41 lux (calculated)
10	Diversity coefficient $\frac{\text{Column 9}}{\text{Column 7}}$	2·15	9·3
11	Glare figure of installation‡	(*a*) 1·2 (*b*) 5·5	(*a*) 1·1 (*b*) 3·7
12	Specific gravity of gas as compared with air = 1	0·5 (approx.)	0·5 (approx.)
13	Calorific value of gas	500 B.Th.U. per c.ft. at S.T.P. = 4760 kilo calories per cubic metre at N.T.P. (wet)	
14	Consumption per unit	210 c.ft. per hour at S.T.P. = 5·58 cubic metres per hour N.T.P. (wet)	60 c.ft. per hour at S.T.P. = 1·59 cubic metres per hour N.T.P. (wet)
15	Composition of gas	Constituent. P.Ct. CO_2 2·5 C_nH_6 3·5 CO 15·0 O_2 0·8 CH_4 22·0 H_2 48·0 N_2 8·2	

* 1 column carrying one 1000 C.P. lamp.

† Calculated from $H = \frac{2\ I_{com}}{sh}\left[1 - \frac{Iv}{I_{com}}\left(1 - \frac{h}{w}\tan - 1\ \frac{w}{h}\right)\right]$ due to W. S. Stiles (Illum. Eng. Vol. 24–189).

‡ Calculated from formula due to W. S. Stiles (Illum. Eng. Vol. 24–162).
As the original formula is not suitable for a street of such great width and close spacing, the street has been regarded as being of half the width, and only the lamps on that side are regarded as contributing to the glare; (*b*) represents the figures obtained in this way; (*a*) represents the maximum glare from one lamp, the observer being situated in the centre of the traffic way, *i.e.*, ¼ way across the whole street.

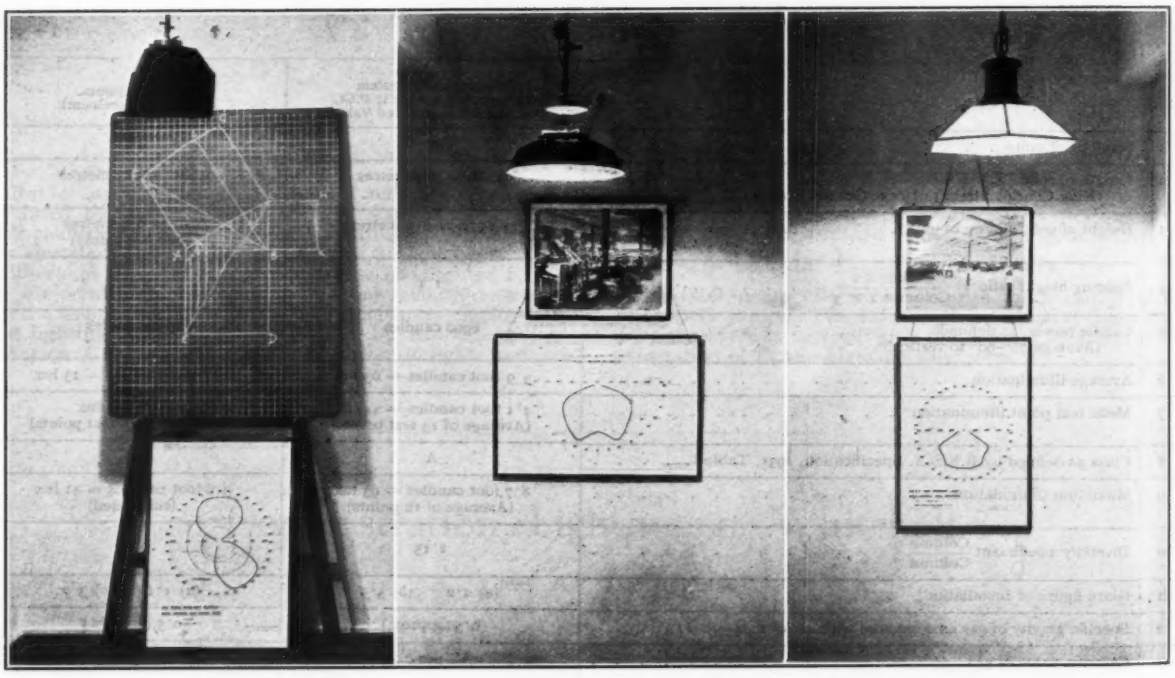
Landscape Lighting of St. James's Park

In the "JOURNAL" for July 29, p. 266, we described and illustrated the equipment used by the Gas Light and Coke Company for the landscape lighting, by gas, of St. James's Park. To carry out this project effectively a new technique had to be developed. This has something in common with recognized flood lighting practice, but there are many essential distinctions. In general, the aim in flood lighting is to project light on a building and to distribute it in a manner to reveal the details of the architecture. The work undertaken by the Gas Light and Coke Company in St. James's Park can be conveniently considered under two headings.

In the first place a number of flower beds have been illuminated, and in the second case a general view has been treated. This latter can be conveniently referred to as "landscape lighting." Experiments have shown that flower beds, to look well under artificial light, should appear in their natural hues and receive light sufficient to bring about an illumination of some 3 ft. candles as measured on a surface normal to the rays provided that the surroundings are reasonably dark. In regard to "landscape lighting" marked contrasts in illumination appear to give best results. In the work carried out in the park this principle has been followed. In order to bring about the desired effects, six types of lighting units were designed, and over 100 units have been used for the work in St. James's Park. To present the flowers as far as possible in their natural hues, "daylight" mantles have been used for the lighting of the flower beds. It is not claimed that the rendering of the hues is exactly correct, but an examination recently made of the distribution of the luminous energy in the spectrum of these mantles did reveal that marked progress had been made towards this ideal.

Landscape lighting may be regarded as being in its infancy in this country, but it is thought that the demonstration provided in St. James's Park should stimulate further development in this class of work. One of the units is the result of co-operation between Messrs. Wm. Sugg & Co. and the Technical Staff of the Gas Light and Coke Company at Watson House. All the other reflector equipment was worked out in the Company's laboratories at Watson House.

Demonstration of Gas Lighting at Watson House



During the Illumination Congress a visit was paid by some of the members to Watson House, the Research and Training Section of the Gas Sales Department of the Gas Light and Coke Company. A special display had been arranged of various lighting units, showing all types of illumination—indoor and outdoor, for home, factory, and street. For the street lighting display, the floor was laid out as streets, and in addition to a large number of street lamps, including one or two very recent developments, luminous posts and danger signals were on view. Regarding indoor lighting, the different units were positioned in cubicles, so that the visitors were able to visualize clearly the effect of any particular fitting. Information as to the light distribution was afforded by polar curves, and typical installations were shown by photographs. Our illustration above is of three of such cubicles. On the left is a new "Nico" shade designed for attachment to units for blackboard lighting and similar purposes. In the centre a Sugg "Worklite" lamp with shallow reflector demonstrated a recent design of fitting for factories and workshops; while the lamp illustrated on the right is a Keith 500 C.P. unit with conical opal reflector. The method of display proved most effective in isolating the merits and indicating the purposes of the various units. The Company are continuing the demonstration for the period of the Congress, and on Tuesday of next week the exhibit will be inspected by the Council, General Research Committee, and Joint Lighting Committee of the Institution of Gas Engineers.

Further Photographs Showing the Wonderful Effects of Landscape Lighting by Gas

A GAS LIGHTED FAIRYLAND IN ST. JAMES'S PARK.

The Spirit of Co-operation.

SIR,—The Committee responsible for making the arrangements for floodlighting the public buildings in London desire to place on record their appreciation of the spirit of co-operation they have found throughout their work, and hope, therefore, that you will find space to publish this letter.

This spirit was first manifested by a willingness to co-operate on the part of the makers of floodlighting equipment. The next step was the readiness of the gas and electric supply authorities to participate. The cable makers, lamp makers, and electrical contractors all agreed that they would share in the work.

The same readiness to help was found when approach was made to the Government Departments, Local Authorities, and others, from whom permits and facilities had to be sought. Most of the public buildings come under the control of H.M. Office of Works, and the Committee in the course of their work necessarily had to make acquaintance with a number of the technical staff of that Department. The Committee would like to put on record, as a matter of great public satisfaction, that the care of public buildings was looked upon as a national trust by each official with whom they had to deal. In addition, they have found on the part of the officials not only an outstanding measure of technical competence, but the greatest willingness to help in every way possible. Night after night these officials have devoted themselves in their own time to giving help, guidance, and technical advice, and everyone associated with them has learned to realize that in this Government service there are men of quality devoted to their work.

On the part of all who have joined in this undertaking, from the Government officials to the shopowners who are keeping their stores lighted up after closing hours, there has been manifested a desire to do something to show that London and Londoners know how to welcome and interest visitors, and something which would assist the trade revival so urgently needed—in fact, to show that this country, in spite of its troubles, still retains its spirit of enterprise, and can face its difficulties with a bright countenance.

In conclusion, the Committee feel that a spirit of readiness to co-operate, such as has been found everywhere, makes it clear that British industry, if given the opportunity, is well able to cope with the difficult times through which it is passing.

P. GOOD,
Deputy Director, B.E.S.A.
(Chairman, London Local Committee,
International Illumination Congress).

Floodlighting of Public Buildings.

[*Sept. 1-25.*]

This programme of illumination has been carried out free of charge by (among others):

Electric Supply	London Electricity Supply Association.
Electric Wires and Cables	Cable Makers' Association.
Gas Supply	Gas Light and Coke Company.

BUCKINGHAM PALACE	General Electric Company, Ltd. Troughton & Young, Ltd.
CLOCK TOWER, HOUSES OF PARLIAMENT	Holophane, Ltd. Siemens Electric Lamps and Supplies, Ltd. T. Clarke & Co., Ltd.
COUNTY HALL	Siemens Electric Lamps and Supplies, Ltd. Rashleigh Phipps & Co., Ltd.
FOREIGN OFFICE	John I. Hall. Brown Bayley Steel Works, Ltd.
HORSE GUARDS BUILDINGS	John I. Hall. Brown Bayley Steel Works, Ltd.
INCORPORATED ACCOUNTANTS' HALL	Society of Incorporated Accountants and Auditors. Belshaw & Co., Ltd. Restlight, Ltd.
INSTITUTION OF ELECTRICAL ENGINEERS' BUILDING	Institution of Electrical Engineers.
LANDSCAPE LIGHTING IN ST. JAMES'S PARK	Gas Light and Coke Company.
NATIONAL GALLERY	Strand Electric and Engineering Company, Ltd.
SOMERSET HOUSE	Edison Swan Electric Company, Ltd. Cecil Cooper & Co., Ltd.
THAMES HOUSE	Imperial Chemical Industries.
TOWER BRIDGE	Bermondsey Borough Council. Stepney Borough Council.
TOWER OF LONDON	Benjamin Electric, Ltd. Anderson, Angell, & Co.
VICTORIA MEMORIAL	General Electric Company. Troughton & Young, Ltd.
WESTMINSTER ABBEY	Holophane, Ltd. Siemens Electric Lamps and Supplies, Ltd. Bell Bros. & Co. (London), Ltd.
WESTMINSTER CATHEDRAL TOWER	Lewenz & Wilkinson, Ltd. Baxter & Caunter, Ltd. Norrington & Landon, Ltd.

EXTENSIONS TO LEICESTER'S GAS PLANT

The addition to the Aylestone Road Gas-Works, Leicester, of a complete section capable of producing 5 million c.ft. of gas per diem became necessary in 1924, and was completed late in 1926. The completion of the section with a storage gasholder of equal capacity to the producing plant presented an opportunity for an official inspection

It is learned from an illustrated brochure prepared for the inspection of the new plant at the Aylestone Road Works of the Leicester Corporation that the Works were acquired by the Corporation in 1878, and that the following are the latest working results:

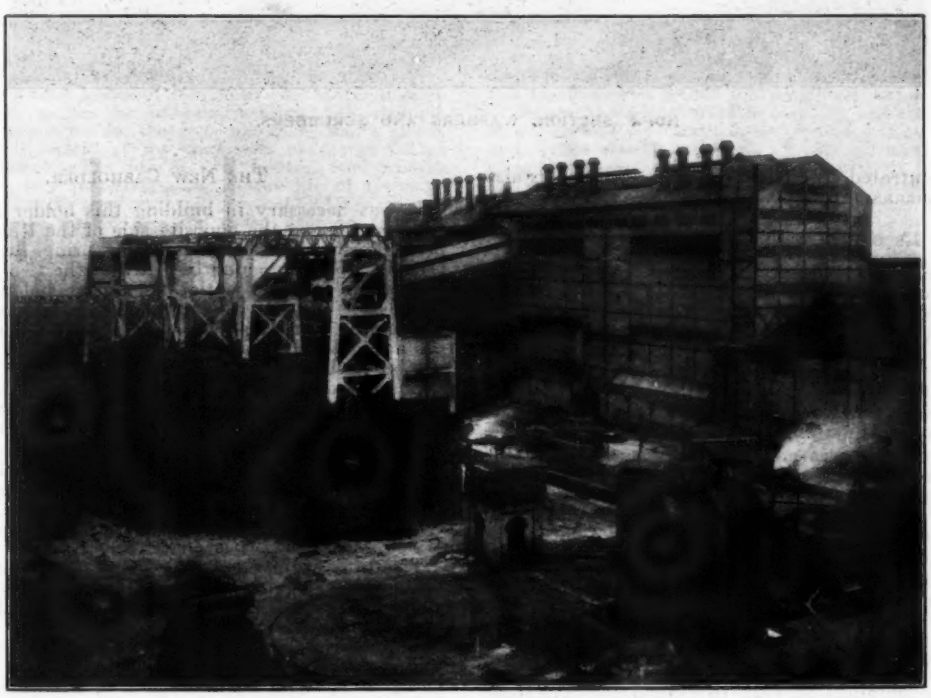
Year 1930-31.

Gas delivered from the works	2,788,072,000 c.ft.
Gas sold	2,740,090,295 ,,
Gas unaccounted for	1·72 p.ct.
Coal carbonized (including oil equivalent)	159,265 tons
Sale of gas per ton of coal carbonized	17,205 c.ft.
Coke made	100,742 tons
Tar made	2,345,563 gallons
Sulphate of ammonia made	1,906 tons

a further eighty-one acres were bought on the other side of the River Soar.

The foundation stone of the Aylestone Road Works was laid in March, 1878. The first section of works was planned by Mr. C. S. Robinson and his brother, the late Mr. G. A. Robinson, who were assisted by a local firm of architects, Messrs. Shenton & Baker, and could then produce 1 million c.ft. of gas per diem, with storage of 1½ million c.ft. provided. A superintendent's house and dwellings for employees were erected at the same time, together with works offices and a clock tower.

In 1884 and 1885 the productive capacity of the works was doubled, and in 1887 it was decided to proceed with the second section, which ultimately produced 5 million



NO. 2 AND NO. 3 VERTICAL RETORT HOUSES.

The present Chairman of the Gas Committee (Councillor H. Carver) was appointed in 1928. Mr. C. S. Robinson and the late Mr. G. A. Robinson were the first Joint Managers of the Department under the Corporation, and on the retirement of the latter in 1880, Mr. C. S. Robinson was appointed Engineer and Manager. He resigned in 1882 and was succeeded by the late Mr. Alfred Colson, M.Inst.C.E., who continued in the position until his death in 1910, when the present Engineer and Manager, Mr. Hubert Pooley, M.Inst.C.E., was appointed to the post.

Belgrave Gate Works.

The original gas-works was built in Belgrave Gate on the present site adjacent to the canal, and until 1879 the town of Leicester was entirely supplied with gas from these Works. The productive capacity of Belgrave Gate Works remained at about 2 million c.ft. per diem up till the year 1914, with storage capacity of a similar quantity.

Aylestone Road Works.

In 1875 the original Leicester Gas Company purchased some thirty-two acres of land at Aylestone Road, on which works for the production and storage of gas, and chemical works, have been built from time to time. Some seven additional acres of land were acquired later, and since then

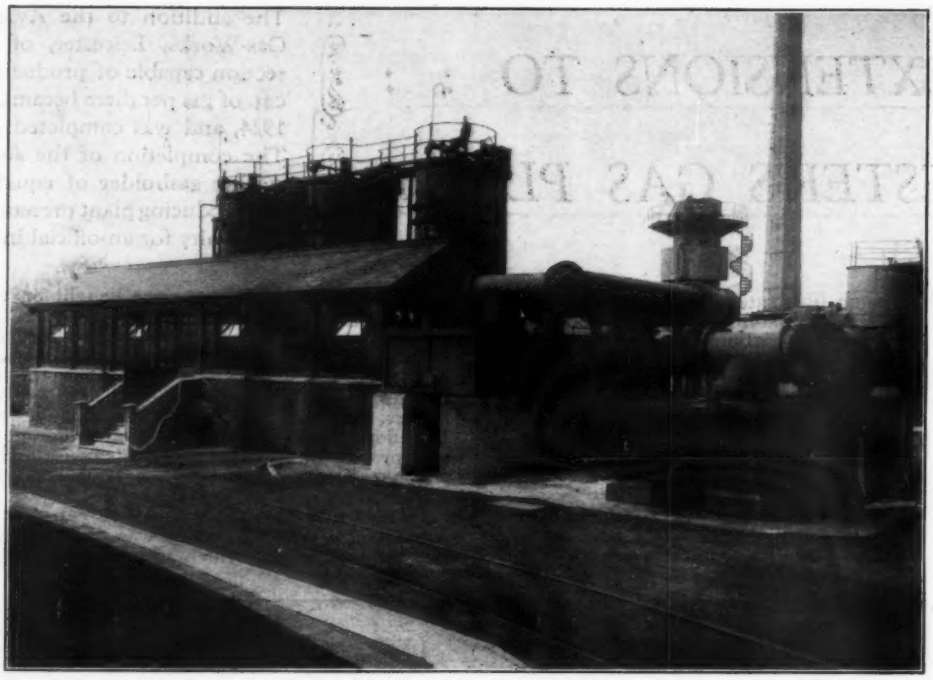
c.ft. of gas in a day. Gasholders were added from time to time, until the storage capacity was increased to a total of 10½ million c.ft. in both works.

The Aylestone Road Works are constructed on land which was subject to flooding, and the surplus excavation and other spoil was used to raise the level of the land about 7 ft. The layout of the Works has frequently been commented upon as among the most perfect of their kind in existence, the credit for which is due in the first instance to the Robinson brothers, and as it developed to the late Mr. Colson. Provision of messrooms, lavatories, and baths for the workpeople was made.

Carburetted water gas plant was put down in the years succeeding 1898 of a total capacity of 3 million c.ft. of gas per diem, and the original electric light installation was also erected on the site to the design of the late Mr. Colson. He was responsible, too, for the admirable cooker repair shop which deals with the repairs and upkeep of 72,000 gas cookers annually.

Chemical Works.

In 1885 and 1886 Chemical Works were erected in the south-west portion of the site. In these works the whole of the tar produced is distilled to the crude products, and the ammoniacal liquor is converted into sulphate of am-



NO. 3 SECTION. WASHERS AND SCRUBBERS.

monia or concentrated crude liquor at will. Sulphur is also recovered by means of a Claus kiln.

Reconstructions Since 1910.

In 1912 the advent of mechanically-propelled vehicles reduced the cost of haulage of coal to such an extent as to make it profitable to adopt the vertical system of gas-making, and the producing plant at Belgrave Gate Works was reconstructed, the output being greatly increased. The advantages having been proved the carbonizing plant at Aylestone Road Works was similarly dealt with, till at the present time the whole of the coal gas produced is made on the vertical system.

Regenerative firing was adopted in connection with tar distillation, and modern stills replaced the older ones in the sulphate of ammonia house. At the same time the carburetted water gas plant was re-modelled, doubling its capacity in the same apparatus.

The maximum output of both the Leicester Corporation's gas-works, after allowing a margin for repairs, and including the new section at Aylestone Road, is 15 million c.ft. per diem.

New Section of Aylestone Road Works.

Powers were obtained in 1921 to extend the Aylestone Road Works by a third section of coal gas plant capable of producing 5 million c.ft. of gas per diem, and this work was put in hand in 1924. The gasmaking system adopted was the Glover-West, which has proved so successful in the reconstruction of the whole of the carbonizing plant at both of the Works.

The plant consists of eight settings of eight retorts each, in two units, and is housed in one of the older coal stores in No. 2 Section. The house is equipped with coal and coke handling machinery of the most modern type. The coal arrives in railway wagons and is discharged by rotary tipplers into the coal breakers. It is then taken to the overhead hoppers on gravity bucket conveyors, whence it is gravitated through the retorts. The coke is dropped on the gravity bucket conveyors, taken overhead, and thence by means of belts to the rotary screens, where it is prepared and stored, ready graded, for the market.

Waste-heat boilers are installed, and the whole of the electricity used on the works is generated by this means, supplemented by gas engine driven dynamos. The exhaust steam from the engines is returned to the retort settings for the generation, *in situ*, of water gas. In this Section water-cooled condensers are used. The older exhauster house belonging to No. 2 Section was re-modelled and now deals with the gas from No. 2 and No. 3 Sections. The necessary washers, scrubbers, purifiers, and station meters were provided for this Section, as well as the new gasholder which has just been completed.

The New Gasholder.

It was necessary in building this holder to erect it on the new site, on the opposite side of the River Soar to the present works. A communicating bridge was built which is virtually a compound box girder, the two sides of which are used as inlet and outlet pipes to the holder. The bridge supports high and low pressure distributing pipes and also forms a means of access from the main works to the gasholder site. It is ultimately intended to place other similar gasholders on the land in the vicinity.

The foundation for the gasholder is a reinforced concrete table supported on 1368 piles of reinforced concrete. The shells of these piles were sunk by means of a mandril with which the shells engaged, and when the desired set was obtained the mandril was withdrawn and the shells filled up with concrete and reinforcement. The preliminary work was tested with a load of fifty tons to the pile. The total load to be carried is about 43,500 tons, of which 41,000 tons is the water content of the tank.

The tank is of steel and is 213 ft. in diameter. The bottom row of side plates is 1½ in. in thickness. It is claimed to be one of the largest steel tanks in the country and requires over 9 million gallons of water to fill it. The gasholder is telescopic and has four lifts, and rises when fully inflated to a height of over 200 ft. above ground level. It contains 5 million c.ft. of gas when filled.

In the construction of the tank and holder, two and a quarter million rivets were used to join up some 7750 steel plates, which vary in thickness from 1½ in. to ¼ in. Three and a quarter miles of channel iron, two miles of angle iron, and one and a half miles of guide rails have been put into the structure.

The chief contractors for the whole of this new section of the Works were as follows:

Retort work, coal and coke handling plant, screens, and reinforced concrete hoppers and telpherage—West's Gas Improvement Company, Ltd.
Condensers—C. & W. Walker, Ltd.
Exhausters—Bryan Donkin Company, Ltd.
Washers and scrubbers—R. & J. Dempster, Ltd.
Tar wells—The Horseley Bridge and Engineering Company, Ltd.
Purifiers—Newton, Chambers, & Co., Ltd.
Revivifying shed—Gibbons Brothers, Ltd.
Twin meters—W. Parkinson & Co., Ltd.
Gasholder, tank, and foundations—R. & J. Dempster, Ltd.
Bridge—Horseley Bridge and Engineering Company, Ltd.
Main pipes—Stanton Ironworks Company, Ltd., and Staveley Coal and Iron Company, Ltd.
The pipes were laid by J. J. Shardlow & Co.

The estimated cost of the completed work of No. 3 Section, including producing and purifying plant, connecting mains, and the new gasholder, was £289,518, and the actual cost has been £262,235.

THE OFFICIAL INSPECTION.

The Official Inspection of the new plant took place on Wednesday, Sept. 2, in pouring rain. The guests were driven in 'buses from the Town Hall to a marquee, which covered the inlet and outlet valves leading to the new gasholder. A platform was erected round these valves, and those taking part in the function were seated on this platform. The Deputy Chairman, Alderman E. Grimsley, took the chair and introduced the various speakers. In turning on the gas from the holder, the Lord Mayor, Councillor H. Carver, J.P., was assisted by the Works Foreman, Mr. Richard Johnson. The visitors inspected the holder, where details of its construction were given, and were afterwards entertained at tea, following which the works were inspected in parties under the guidance of Mr. Hubert Pooley, the Engineer and Manager, and his assistants.

The CHAIRMAN (Councillor H. Carver, J.P., who is Lord Mayor of Leicester) at the Official Inspection said that at the present time, the Department, in common with almost every other industrial undertaking, was passing through a period of unprecedented trade depression. That this was having an adverse effect upon the undertaking's output was only natural when it was remembered that, apart from the local factories which used gas for power and industrial purposes, practically every household in the City used gas for some domestic purpose; and with the depression in the staple trades becoming so bad and so prolonged, people were forced to economize even on the necessities of life, such as gas for lighting, heating, and cooking. This view was supported by the fact that there was a steady increase, week by week, of the consumers connected to the Department's mains. The provision of lighting and heating facilities was a very material factor in the life of the community, and although they were all cognizant of gas and its service, there were certain uses for which gas was specially suited, but which they in this country had not, as yet, taken advantage of to the fullest extent.

In cooking, continued the Chairman, gas offered a standard of service which no other fuel could. Again, the gas fire had not been appreciated to the extent it merited. The gas fire was the healthiest form of smokeless heating available, combining as it did the beneficial ventilation of the coal fire without its smoke, dust, and ashes, with a radiant warmth which could be readily adjusted to one's needs.

The recent appreciation of two further adaptations of gas to domestic needs—namely, water heating and central heating, was very encouraging. The saving of fuel storage space, the thermostatic control regulating the consumption of gas to a minimum, and the elimination of all labour were advantages which would appeal to the architect and the housewife. In the case of water heaters, the Leicester Gas Department had recently introduced a scheme for the hiring of this apparatus, free of fixing costs, on attractive terms to both ordinary and prepayment consumers. In the case of central heating by gas, both for dwelling houses and for public halls and the like, the Committee offered most favourable terms.

A SAVING ON THE ESTIMATE.

A very pleasing feature of the installation of this latest complete producing, purifying, and storage plant, went on the Chairman, was that the cost of erection, which in the first place was estimated at £289,518 (or £232 per million of gas output) showed a saving of £27,283 on that figure, the actual cost being £262,235 (or £210 per million). This was very gratifying and showed good estimating coupled with efficient management and supervision, and the Committee were justly proud of this excellent addition to their works, already numbered among the foremost of their kind.

The provision of this new section of works was based upon a normal ten years' progress, and the Committee were confident that, given a return to normal conditions in trade and a fair appreciation of the merits of gas, both as a domestic and an industrial fuel, the future would be very bright for the City of Leicester Gas Department.

It might interest the visitors, the Chairman said, to know that the total capital outlay on the two works had amounted to £2,110,000, reduced by payments out of profits of £1,160,000, leaving a debt of £950,000. In addition, they had paid to the relief of the rates over £900,000. In eight years their customers had increased by 14,000.

In conclusion, he referred to the able, diligent, and loyal service of the Engineer and his staff and workmen. Some of the processes in connection with the erection of this new section of their works had been of a very delicate and dangerous character, requiring great skill and care, and he knew that the staff and workmen, to a man, had risen to the occasion, and he was glad, on behalf of the Gas Committee, to have this opportunity of recognizing their valuable service. "In formally turning on the gas from the new holder," said the Chairman, "may I express the hope that this new section of our works may prove to be of great service to the citizens of Leicester?"

INCREASED PRODUCING CAPACITY.

Mr. HUBERT POOLEY, M.Inst.C.E. (Engineer and Manager), remarked that this function clashed with the International Illumination Congress being held in London at the same time, and for this reason it was purely of a domestic character, the more important gathering naturally having a prior claim upon the attention of gas engineers of the country.

It would no doubt surprise many of them, he said, to know that the total producing capacity of the two Leicester gas-works had been increased by 66 p.ct. since the years just prior to the war, and that this had been accomplished without materially increasing the acreage of the works. The chief factor which had made this possible was the introduction of vertical retorts for gas making in the place of horizontal retorts. The handling of the coal, right from its entry into the works to the time it passed through the retorts, and of the resultant coke, from the time of its discharge from the bottom of the retort up to its dispatch from the works, was entirely mechanical. The plant was continuous in action and practically automatic.

The actual work involved in planning and erecting the Works which were to be inspected, he continued, was very great and needed the closest attention. It was pleasant to be able to state that the whole was carried out without friction and with the most cordial assistance from all the contractors; there were, of course, difficulties which were smoothly got over.

THE GASHOLDER.

In the building of the new gasholder it was necessary, owing to the nature of the site, to place the tank above the level of the ground, and the foundation, which was a reinforced concrete table supported upon 1368 piles, was carried out very successfully by Messrs. West's Rotinoff Company, Ltd., subcontractors under Messrs. R. & J. Dempster, Ltd. The erection of this new gasholder was no mean engineering feat, and they would gauge the exactitude with which the work was carried out when he told them that the tank when completed and first filled with the nine million gallons of water it held, was found to be water-tight and to have no need of any caulking. The whole of the work of the contracting firms had been carried out to the greatest satisfaction of the management, and the addition to the works was such as the citizens of Leicester should be proud to possess.

Mr. Pooley said he was greatly indebted to his assistant, Mr. Fiddes, and to the engineering staff at Aylestone Road Works for the excellent manner in which they had supervised the carrying out of the work and also for the help they so willingly gave in planning the layout and design of the plant. A gas-works was something more than a gas generating station, producing as it did coke, tar products, and sulphate of ammonia, and with an efficiency of about 80 p.ct. it could claim to be the most economical method of utilizing the great national coal resources.

The City of Leicester Gas Department, concluded Mr. Pooley, would be able, when the return to more normal conditions came again to take its share of the improved standard of living which the increased use of gas provided. The technical staff of the Undertaking was always at the service of the public, to advise as to the latest developments in the use of gas for both domestic and industrial uses, and was always willing to carry out experimental work in the adaptation of gas to any particular needs.

Ald. FRED WEST, of Manchester, and Mr. CHARLES DEMPSTER, of Messrs. R. & J. Dempster, Ltd., both spoke on behalf of the contractors concerned, and referred to the excellent new works in possession of the City of Leicester Gas Department.

Street Lighting and "Relief" Illumination in Birmingham

A Fine Example

BIRMINGHAM TOWN HALL BRILLIANTLY GAS LIGHTED.

The members of the International Illumination Conference on their visit to Birmingham will find much of interest in the system of street lighting which has been in vogue on the Hagley Road for about a year. This road was chosen as being a particularly suitable thoroughfare for the purpose of carrying out tests for showing the efficiency of gas and electricity for street lighting. The road has been divided into six sections, each about a third of a mile in length. There are three systems of lighting by gas and electricity. In the first the lamps are placed on standards on both sides of the road. In the second system the road is centrally lighted, and in the third method the lamps are "staggered." In each instance the gas lighting is on the ordinary low-pressure system, with the use of 8-light Sugg "Rochester" lamps, No. 2 mantle. In each of the three divisions a third of a mile of the road is illuminated by gas, and another third of a mile by electricity.

In connection with the visit of the Congress, an interesting scheme of "relief" lighting of the Town Hall is carried out in which gas is the illuminant. The exterior of the building is illuminated by two concealed incandescent high-pressure gas lights (of 1500 C.P.) with suitable parabolic reflectors placed at the foot of and just behind each of the Corinthian columns which surround the main body of the hall. There are fifteen columns on each side of the building and eight columns in front; the rear part of the Hall, adjoining Chamberlain Square, is not illuminated. The result is to give an excellent silhouette or "relief" effect, the columns themselves standing out in dark outline against the illuminated wall behind. Owing to the blackened condition of the building the task was one of some difficulty, but the lighting is thoroughly effective. The work has been carried out under the able direction of Mr. R. G. Rogers and Mr. Marsh, of the Birmingham Gas Department.

It is believed that this is the only serious attempt to illuminate a public building in this way by gas during the visit of the delegates of the International Illumination Congress; and the demonstration will take place on Thursday, Friday, and Saturday.

Victoria Square, facing the Council House, is lighted by means of high pressure gas lamps. The present installation was put up in 1911, only minor alterations to the positions of the lamps having been made, due to changes to the central island. The lamps are of a nominal candle power of 4500 each, and are fixed at a height of about 19 ft. from the ground to the mantles. They are placed at varying intervals round the entire square with four separate lamps on the main island. The road surface illumination at minimum test points in the square varies from 2 to 3 foot candles, and therefore the installation gives an effect that brings it well within Class A of the B.E.S.A. Specification. The ornamental lamps on the refuges in Victoria Square have been specially designed for the purpose of meeting the requirements of a central square. Paradise Street, leading out of Victoria Square towards Broad Street, is illuminated by high pressure gas lamps suspended on cables across the roadway. These lamps are also 4500 nominal candle power and give an illumination on the road surface up to as much as 4 foot candles. The average of a number of measurements at the positions at minimum illumination is considerably above 2 foot candles, so that this area also comes into Class A lighting.

It may be added that certain portions of the interior of the Art Gallery are illuminated by high-pressure gas lamps. The burners are fixed beneath ventilating shafts in the ceiling, the heat from the burners being utilized to induce a keen up-draught in the ventilating shafts.

CONGRESS PAPERS

PRESENTED IN EDINBURGH ON SEPT. 7

Lighting of Seaside Resorts

A. P. ALLAN, Engineer and General Manager, Scarborough Gas Company, and J. M. CAMPBELL, Engineer and General Manager, Isle of Thanet Gas Light and Coke Company, Margate

From time to time standards of illumination for our streets are set up by illuminating engineers and other authorities interested in the safety of the public. It is not the object of this paper to discuss those standards, as other papers before this Congress will undoubtedly deal with the scientific aspect of the street lighting problem. It may be remarked here, however, that those standards of illumination are still far in advance of the actual illumination provided in the vast majority of the streets of our cities and towns.

PUBLICITY VALUE OF SEASIDE LIGHTING.

There is, however, one group of towns in every country with access to the sea which really cannot *afford* to be behind the times in this matter of the provision of adequate illumination. I refer to the popular seaside resorts. The popular seaside resort *must* have brilliant illumination, not only to ensure the safety of the crowds that congregate there, but because one of the obvious factors in attracting the crowd is the brightness and cheerfulness of the town by night. It can truly be said that any popular seaside town which, in the lighting of its sea front, its promenades, and its principal streets, adopts a standard of illumination considerably above any "safety" standard set up by illuminating engineers, is taking but a common-sense step in the interests of its own prosperity.

Just as that great London shopping centre, Regent Street, is brilliantly lighted at night not only to ensure the safety of those passing along it, but to attract shoppers and sightseers, so every seaside town which aims at drawing the crowds should be brilliantly illuminated at night time.

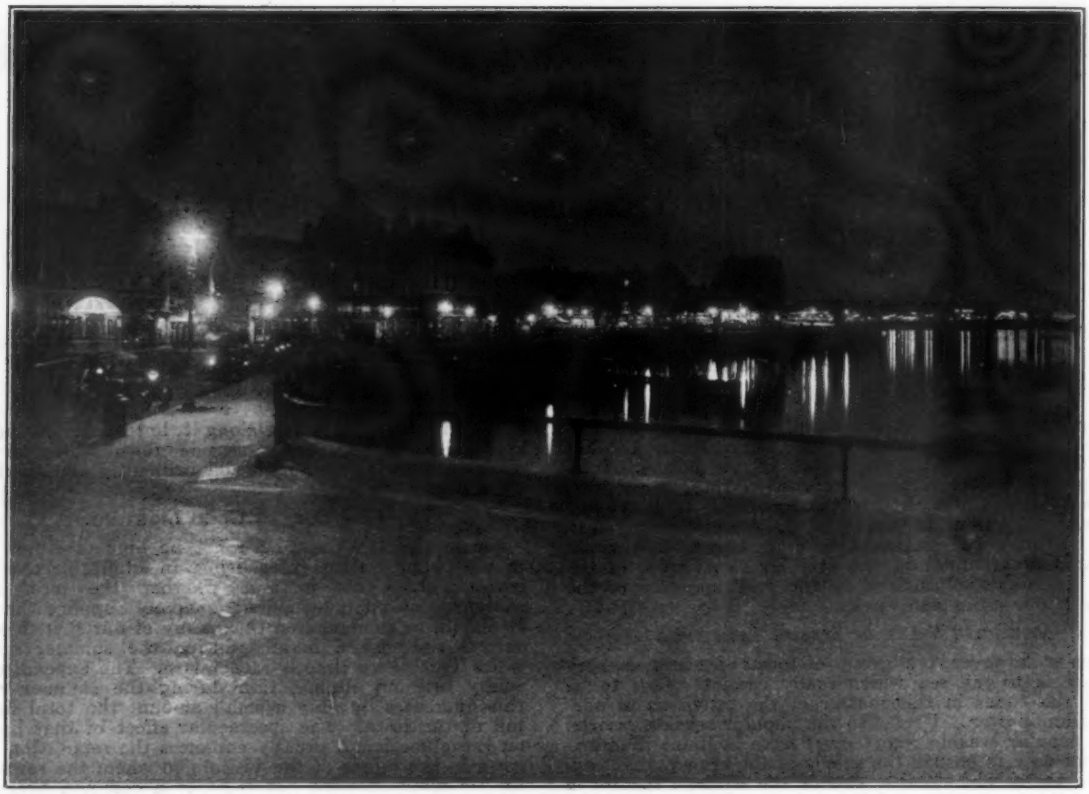
LOW COST OF GOOD LIGHTING.

Fortunately the cost need not be high—the few pence in the pound on the rates being an admirable communal investment. This is true whether the local rating authority or an independent company supplies the light. It should be remembered that many of our British seaside resorts are visited mainly during the summer months, when lighting-up time is rather late. The expenditure on really brilliant illumination during the summer season thus increases by only a small amount the total lighting bill of the town. The spectacular effect of that lighting, on the other hand, greatly enhances the reputation of the town in the minds of the visitors to whom the town looks for its main support. It is quite a common practice in some of these towns to reduce the number of lamps in lighting on the promenades during the "off" season, in the interests of economy; frequently, too, because the heavy seas of the winter render the retention of the lamps on the fronts either inadvisable or impossible.

Unfortunately, in spite of the good publicity value of spectacular lighting, some seaside resorts still lag behind in this matter. There are, however, a number of good examples of seaside lighting in this country, and it is the

SCARBOROUGH SPA.—ITALIAN TERRACE FROM BALL ROOM.

This view of the Italian Terrace of Scarborough gives some idea of the brilliance and the dignity of the gas lighting. The gas used on the Spa is paid for, *via* the meter, at ordinary rates, less the standard discount to large consumers. The owners of the Spa are obviously wise in providing spectacular lighting of the kind shown, as it attracts the public and thus helps to increase the Company's revenue. The installation is always kept in perfect order by the local gas undertaking. It would be difficult on any evening to find a broken mantle in any public lamp in Scarborough.



MARGATE.—PARADE AND MARINE DRIVE.

The Parade and Marine Drive, Margate, looking west from the harbour. The reflections from the gas lighting make this viewpoint a favourite one with visitors at night-time. The local Gas Company have always given every possible assistance to the Margate Corporation in their task of keeping the lighting of the town up to date. With this end in view, the Company, on their own initiative, from time to time install lamps of new and improved design in suitable places, so that members of the Lighting Committee may see the results and decide whether a change from the older system to a newer one is worth while.

object of this paper to refer in particular to two of them —Scarborough and Margate.

THE LIGHTING OF SCARBOROUGH.

Scarborough has deservedly earned its reputation as "Queen of Watering Places." It is beautifully situated, and its main features are two extensive bays separated by a promontory—the Castle Hill—on which are the ruins of a Norman Keep. Oliver's Mount, at the southern end of the town and some little distance inland, dominates the resort, and is the site of Scarborough's War Memorial. From this memorial the view by day is a fine one, but by night it is perhaps even more imposing. Down below, practically the whole of Scarborough can be seen, with its promenades a conspicuous curved "ribbon" of brilliant, dignified lighting, its main street only slightly less well defined, and its smaller thoroughfares also clearly discernible, though naturally not lighted on quite so generous a scale.

A Well-Conceived Lighting Scheme.

Scarborough's promenades and streets are lighted throughout by gas lamps, and the town is to be congratulated on the consistent manner in which the whole lighting scheme has been conceived and carried out. Here is no conglomeration of dozens of different types and sizes of lamp, but the consistent use of four sizes of gas lamp, according to the needs of the thoroughfare.

The lamps at present in commission consist of:

427	12-light	"Littleton" lamps.
202	6 ,,	,, ,,
265	4 ,,	,, ,,
1159	2 ,,	14-in. "Windsor" lamps.

All are provided with No. 2 mantles on superheaters, constant pressure governors giving an outlet pressure of 25/10ths, and fixed nipples drilled to pass 2½ c.ft. per nozzle.

Height of Lamps.

The 12-light lamps are fixed on 14 ft. columns specially erected for the purpose, and the height from the ground to the mantles is 16 ft. 8 in. The smaller units are fixed on the 10 ft. 3 in. columns originally used for lamps of lower candle-power, the heights from the ground to the mantles being respectively 12 ft. 11 in., 12 ft. 5 in., and 11 ft. 6 in.

The 12-light lamps are fixed on the sea-front and in the more important roads of the town. No less than 170 are used for the lighting of the three miles of sea front. On the foreshore they are only 20 yards apart; on the Marine Drive they are 27 yards apart, and in the main streets from 25 to 40 yards. The standard distance apart of the lamps in most of the other roads is 50 yards, measured diagonally across the street, the lamps being staggered.

In all there are nearly ten miles of roads lighted by 12-light lamps. Four miles are lighted by 6-light lamps, and the remaining thirty-five miles by lamps of lower candle power.

All lamps throughout the town are automatically lighted and extinguished by clockwork controllers, and these have proved to be in every way satisfactory. Never at any time has there been a failure in the public lighting system at Scarborough. This is a matter of some importance to a town which at certain times of the year is very crowded.

A Brilliant Corner.

When the new Corner Café of the Corporation on the North Bay was completed a few years ago it was decided to provide special illumination on the walk immediately in front of it. For this purpose eight 12-light gas lamps were erected, and a special column was designed and fixed on an island site. To this column were attached four 12-light suspension lamps of the same make as those used throughout the town. The result is very pleasing and has undoubtedly had a considerable influence in attracting large numbers of people to this part of the promenade at night time, thereby helping to increase the number of visitors to the café.

The Lighting of the Spa.

The well-known Spa at Scarborough is owned by a private company, but it is lighted on lines even more generous than those of the sea front. On the Spa promenade the lamps are spaced only 15 yards apart. The gas used is paid for, via the meter, at ordinary rates, less the standard discount allowed to large consumers.

It is hoped to have ready, for the inspection of delegates

when this paper is read, photographs of some of the Spa lighting, from which they will be able to form a general idea of the amount and quality of the light provided.

An indication of the progressive attitude of the town authorities in this matter of street lighting will be gained from the following notes on the increases in expenditure and increases in illumination provided in the town.

On the Foreshore, some seven years ago, the lamps were placed 40 yards apart and each had only one No. 2 mantle. To-day, as already stated, the lamps are 20 yards apart and are fitted with 12-light superheater clusters.

In the residential streets the amount of light provided everywhere has been at least doubled during the last seven years, and in many cases increased by from three to twelve times as much.

In 1913 the annual sum expended on public lighting was £3386. In 1923 this figure had increased to £4620, that increase, incidentally, being due mainly to the higher post-war price of gas. In 1923 the improvement of the lighting was commenced. The first section of this scheme resulted in the raising of the total cost for lighting to about £8000. At the present time the annual cost has risen to just over £9000. These figures are not strictly comparable, as during the passage of time new roads have been constructed, and the cost of their lighting is, of course, included in the later figures. While the annual consumption of gas for public lighting is now about four times as much as it was in 1923, and the cost of lighting has been doubled since 1923, it is interesting to note that the total illumination provided has been increased at least sixfold.

Maintenance.

The policy of the Gas Undertaking is to supply the lamps and columns and maintain them in good lighting order at an inclusive cost per lamp per annum.

Each lamp attendant has charge of an average of 200 lamps. He has to wind and set the clockwork controllers, to attend to all mantle renewals, to keep the lamps clean and the burners correctly adjusted, and to make certain that every mantle is in perfect condition. Any mantle showing the slightest imperfection is replaced immediately. Every lamp is inspected twice daily by the attendant, who is provided with a cycle for this purpose. In addition to this, the district is regularly patrolled by the Gas Company's official in charge of the public lighting. Although Scarborough, like most seaside towns, is subject to gales, the average mantle usage during the last five years has been only 3·2 per nozzle per annum. Yet it is true to say that, on most occasions, a tour of the district will not reveal a single mantle which is not in perfect condition. It is not surprising to hear, therefore, that the Chairman of the Lighting Committee of Scarborough recently remarked that "in comparison with other towns, Scarborough's lighting is second only to that of London, and there have been requests from other authorities for information about the lighting of the streets. My Committee," he said, "are quite satisfied with the way the Gas Company treated them."

Experiments with Directional Reflectors.

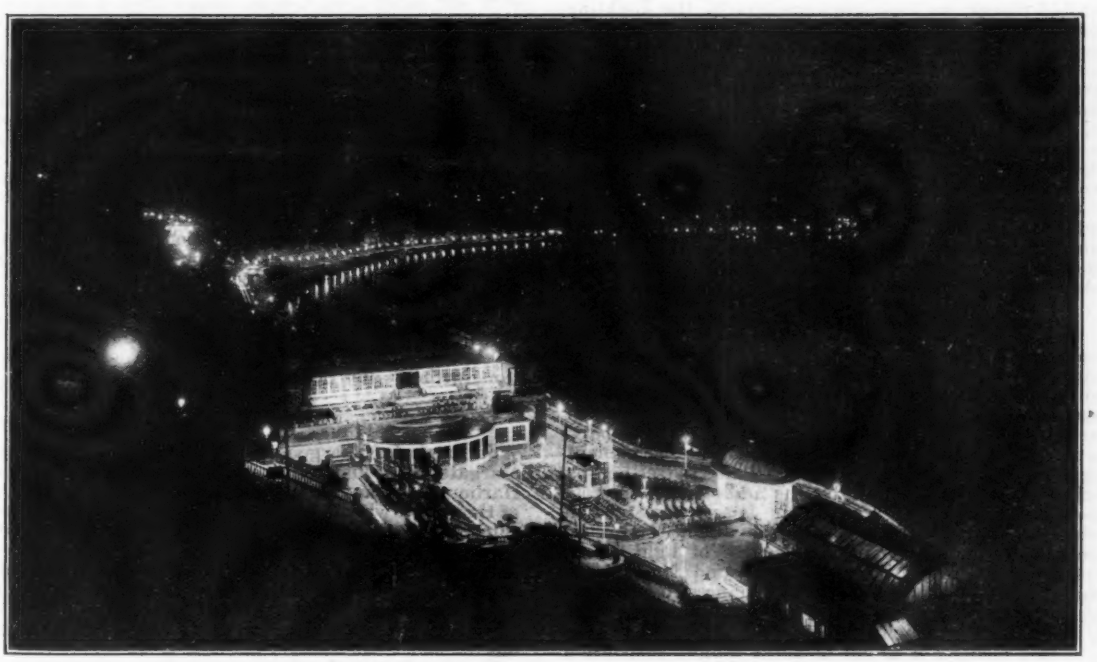
It may be mentioned in passing that the Scarborough Gas Undertaking is experimenting with stainless steel directional reflectors which have been fitted in a number of 12-light and 2-light lamps. An improvement in the distribution of light has resulted, and the experiment is now being continued in order to make quite sure that the reflectors stand the test of time and the effects of the sea air.

THE LIGHTING OF MARGATE.

From Scarborough we come further south to Margate. For the information of our visitors, it may be said that Margate has long held the envied reputation of being one of the finest resorts on our coasts for what we English call a "pick-me-up." Busy people who have been ill, or who through over-work have become run down and have only one or two days in which to convalesce, go to Margate for the week-end, where its invigorating air works wonders in a short time. Apart from this valuable natural asset, Margate, which is a very progressive town, goes out of its way to provide the best of outdoor and indoor attractions of every kind in the shape of pleasure parks, bathing pools, facilities for sport, up-to-date shops, first-class concerts, theatrical performances, and the like. During its main season the accommodation of every hotel and boarding house is booked up to its limits, while at other times of the year the town is favoured with a surprisingly good and regular influx of visitors, despite the fact that it is not generally classed as a town with an "all-the-year-round" season.

Attractiveness of Light.

The town authorities have at all times looked upon the lighting of Margate's "Front" as one of the important factors in the steady increase of its popularity and prosperity. Improvements are continually being made to its street lighting, bearing always in mind its propaganda or publicity value to the town generally and to its tradesmen in particular. It may safely be assumed that, provided the scheme for lighting the promenades and roads of such a town is in the hands of qualified illuminating engineers,



SCARBOROUGH.—VIEW OF SPA AND SOUTH BAY.

There is one group of towns which really cannot afford to be behind the times in the matter of the provision of adequate illumination—the popular seaside resorts. These must have brilliant illumination, not only to ensure the safety of the crowds that congregate there, but because one of the obvious factors in attracting the crowd is the brightness and cheerfulness of the town by night. Scarborough—the "Queen of Watering Places"—recognizes the importance of brilliant lighting. The illustration shows the South Bay and Spa with Italian Terrace and Forecourt in foreground. Scarborough's streets and promenades are lighted throughout by modern gas lamps.

MARGATE JETTY.

Margate Jetty, which corresponds to the pier of other resorts, is run under the auspices of the Margate Pier and Harbour Company. For its illumination thirty-six 12-light gas lamps have been provided. These are attached to the sides of the jetty on short ornamental columns in staggered positions, and they give a brilliant and very uniform lighting effect over the whole of the promenade. At periods of high tide the view of this jetty with its lights reflected in the sea is a most attractive one, frequently commented upon by visitors.

that lighting which attracts visitors, on account of its brilliance, will also be more than adequate in making the thoroughfares safe from the traffic point of view, in so far as street illumination affects safety.

The public street and promenade lighting of Margate is almost entirely by gas, the lamps being equipped with from two to as many as fifteen mantles.

The local Gas Company has always given every possible assistance to the Margate Corporation in their task of keeping the lighting of the town up-to-date. With this end in view, the Company, on its own initiative, from time to time installs lamps of new and improved design in suitable places, so that the members of the Lighting Committee may see the results and decide whether a change from the older system to a more modern one is worth while. In this way Margate is always one of the first resorts to gain from any improvement in the design or efficiency of gas lamps effected by the lamp manufacturers.

The "Littleton" lamp was first introduced to Margate by the experimental erection of specimen 9-light lamps on the existing 9 ft. 6 in. columns, short extension pieces being added to the columns to raise the lamps because the intensity of the light was rather high for a short column. This experiment provided an opportunity for the Margate Corporation Lighting Committee and other officials to see the improved effect of the lighting.

Lighting of Margate Sea Front.

Subsequently this type of lamp was adopted for the lighting of the entire sea front for a distance of nearly six miles. The 5-light and 9-light lamps chosen for this purpose are fixed at average distances of 30 yards apart on each side of the widest roads, and 46 yards apart, "staggered," in the narrower roads. The permanent raising of the height of the lamps was effected either by the fixing of new columns, or by the adding of a cleverly designed extension piece. The 5-light lamps were erected on columns 9 ft. 6 in. high, and the 9-light lamps on columns 12 ft. high, bringing the source of light 12 ft. and 14 ft. 8 in. respectively above ground level. The lighting of the "Front" is further enhanced by the fixing of a 9-light suspension lamp at each corner of the Clock Tower, the height to the light source being 12 ft. 6 in.; also by a group of three 3-light suspension lamps on each of the two columns situated in the approach to the Southern Railway Station. The height of the mantles in this case is 13 ft. 9 in. above ground level, and the columns are on refuges 8 yards apart. The illumination from these lamps is well distributed, there is no appreciable shadow, and the light is well adapted to the limitations of the human eye.

The under-cliff promenades are uniformly lighted with square taper lanterns of the "Windsor" type fitted with two inverted burners with No. 1 mantles. These lamps are fixed 45 yards apart on columns which bring the source of light 11 ft. 6 in. above ground level. One of the promenades adjoining the jetty, where lighting by electricity was at one time temporarily installed, is now lighted by 9-light gas lamps.

The Lighting of New Roads.

The roads serving new housing estates in the Margate area are lighted by 2-light lamps (No. 1 mantles) fixed about 45 yards apart. Square taper lamps, of a design which causes the minimum possible obstruction to the light, have long since displaced the older type of lamp with heavy corners which cast rather deep shadows along and across the road. Fitted as the newer lamps are with efficient reflectors which are always kept clean, the result is a good even illumination along the road, with no dangerous dark patches.

Dangerous corners and bends throughout the town are equipped with lamps of higher candle power, and the Corporation are at the present time considering the desirability of increasing the illumination along the bus routes. This may involve the re-arrangement of the lighting units and spacings to meet the needs of the steady increase in traffic. In narrow streets and at points where the erection of a column might be inadvisable, suspension lamps are fitted, and these have proved to be most effective by reason of their light being well distributed in a downward direction, without any obstruction.

Margate Jetty.

So much for the general lighting. The illumination of Margate Jetty under the auspices of the Margate Pier and Harbour Company deserves mention. For the illumination of this jetty, which corresponds to the pier of other resorts, thirty-six 12-light lamps have been provided. These are attached to the sides of the jetty on short ornamental columns in staggered positions, and they give a brilliant and very uniform lighting effect over the whole of the jetty promenade. At periods of high tide the view of this jetty with its lights reflected in the sea is a most attractive one.

The lighting of the shelters has always been regarded by the Margate Corporation as a feature deserving careful consideration. For the lighting of the main public shelters along the sea front, suspended lamps of a suitable size have been fixed in such positions that people using the shelters can read comfortably when sitting there—if they so wish. (A suggestion that the new gas switches should

be provided by which the light can be dimmed at will has not yet received official consideration!)

Automatic Lighting and Extinguishing.

Every public lamp in Margate is operated by clockwork controller, being lighted up and extinguished at pre-determined times, with a weekly change—at any rate so far as the lighting-up time is concerned. Rather more than half of the lamps are regularly extinguished at midnight throughout the year. Corner lamps and others at dangerous points are left alight all night and extinguished (with the other lamps which have been left burning after midnight) half-an-hour before sunrise.

The town is divided into nine districts for maintenance purposes, the number of lamps attended to per man varying in accordance with the compactness or otherwise of the districts. The maintenance work is organized on lines very similar to those adopted at Scarborough, and a repetition of details is therefore unnecessary. In both towns a competitive spirit on the part of the men is definitely encouraged, with the result that the standard of the work has attained a very high level.

Illumination Doubled in Three Years.

The progress made in the lighting of Margate during the past few years has been very marked. The number of lamps in use in 1927 was 1354. By 1930 the figure was 1656—an increase of 302, just over 25 p.ct.—but the *illumination* provided (as the result of the substitution of higher candle-power for lower candle-power lamps in many streets) had been more than doubled.

That the Corporation is satisfied with the lighting service provided will be appreciated from the remarks made in public some time ago by Mr. Harold Emptage, the Lighting Superintendent. He said: "The introduction of automatic control of the public street lamps has led to a great improvement in the efficiency of the lighting from all points of view, and incidentally to a substantial reduction in the lighting rate, which, two years ago, was 8d. in the pound. To-day, in spite of increased number of hours lighting, increase in the number of lamps and their lighting value, the rate for the current year is 5⅜d. in the pound." (The lighting rate for the present year has been increased to 5¾d. owing mainly to further improvements and additions to the public lighting.)

Windproof Lamps.

It will be obvious that, owing to the exposure of the lamps to the high gales experienced at these resorts on the North Sea front, lamps of very sound windproof construction are essential. It is fitting therefore to pay a special tribute to the design of the lamps described in this paper. In both towns it is a rare occurrence to find a by-pass out even in the most exposed positions.

It is probable that the time is not far distant when a satisfactory method will be devised whereby the need for a by-pass will be abolished. It is to be hoped, however, that this useful discovery will not result in the adoption of less substantial and less attractive lamps than those at present in use.

The following table shows the improvement in diversity factor which results from an increase in the height of the light sources. The diversity factor is, of course, only one of a number of points which have to be considered before a decision is made as to the best height for a lamp, but the table may be of some use to those who are considering this question.

Horizontal Illumination from Various Light Sources.

[Two lamps included in minimum illumination.]

Distance between staggered lamps—measured along kerb—150 ft.; distance between lamps on same side of street, 300 ft.

Light Source.	Height.	Width of Roadway.	Distance Between Lamps.	Maximum Horizontal Illumination.	Minimum Illumination. B.E.S.A. Test Point.
	Ft.	Ft.	Ft.	Ft. Candles.	Ft. Candles.
4-light lamp	12	30	150	2·68	0·014
	13	30	150	2·25	0·015
	14	30	150	1·94	0·016
6-light lamp	12	30	150	4·06	0·018
	13	30	150	3·46	0·020
	14	30	150	2·98	0·021
	15	30	150	2·6	0·022
	16	30	150	2·28	0·023
9-light lamp	15	30	150	3·76	0·035
	16	30	150	3·32	0·038
	17	30	150	2·94	0·040
12-light lamp	16	30	150	4·45	0·045
	17	30	150	3·82	0·050
	18	30	150	3·53	0·051

The Extensive Use of Gas for Seaside Lighting.

In conclusion, it may be pointed out that the lighting of seaside resorts by gas is obviously not confined to the two examples referred to in detail. Unfortunately, complete statistics relating to our seaside resorts are not available. Information received, however, from 49 typical seaside resorts in this country revealed the following:

Number of Towns.	Total Number of Gas Lamps.	Total Number of Lamps other than Gas.
35	26,615	6437

Number of Towns.	Number of Miles of Street Lighted by Gas.	Number of Miles of Street Lighted by other Systems.
14	806½	249½

Reference to the latest returns of the Gas Industry shows that, of the 153 principal towns and villages on the seacoast of Great Britain where there are gas undertakings, 12 have more than 50 public gas lamps, 64 more than 100, 18 more than 500, and 23 more than 1000. In this total of 153 towns and villages round our coast there are over 125,000 gas lamps in use for public lighting. From these figures it will be obvious that gas plays a very important part in the lighting of our seaside resorts and seaside towns. This is no exception to the general rule, so far as the lighting of streets is concerned. A recent survey of some of the public lighting in this country showed that, in 318 cities and towns, 13,341 (80 p.ct.) of a total of 16,559 miles are lighted by gas, and that, in 293 cities and towns, there are 378,434 gas lamps (74 p.ct.) in use out of a total of 514,401 street lamps.

Street Lighting by Gas in South London

By the Public Lighting Department, South Metropolitan Gas Company

Statistical.

London is supplied with gas mainly by three Companies; the Gas Light and Coke Company supplies the whole of the county north of the Thames (except Poplar and Stepney) and three small areas (parts of Battersea, Lambeth, and Wandsworth) south of the Thames; the South Metropoplitan Gas Company supplies the whole county south of the Thames (except parts of Battersea, Camberwell, Lambeth, Lewisham, and Wandsworth) and the Commercial Gas Company supplies East London north of the Thames (Poplar and Stepney). Other Companies that supply London with gas are the South Suburban Gas Company (parts of Camberwell, Lambeth, and Lewisham), and the Wandsworth, Wimbledon, and Epsom District Gas Company (part of Wandsworth).

The boroughs of South London, partly or wholly included in the area of supply of gas by the South Metropolitan Gas Company, are Battersea, Bermondsey, Camberwell, Deptford, Greenwich, Lambeth, Lewisham, Southwark, Wandsworth, and Woolwich.

The total length of streets in these boroughs is 1029 miles. Over 90 p.ct. of the total length of streets within the statutory area of supply of gas by the South Metropolitan Gas Company is illumined by gas. The number of public gas lamps in the area is 24,529. The public lighting rate levied in these boroughs ranges from 2·80d. in the £ in Lambeth to 4·24d. in the £ in Battersea.

As cost is of prime importance in matters of public lighting, it may here be stated that, within the area referred to, the average cost of street lighting per mile per annum, is, according to the latest available returns,* almost

* "London Statistics," **33**, p. 248.

halved in those boroughs in which public lighting is entirely by gas, compared with those boroughs in which gas and electricity share the public lighting load, the respective figures being £154 per mile per annum for boroughs using gas exclusively for public lighting, and £273 when gas and electricity are used.

Public lighting within the Company's area of supply has been subject to revision from time to time, older types of burners being replaced by more modern and efficient ones. The great economies and increased efficiencies effected by these revisions is seen from Table I. herewith:

TABLE I.

Year.	No. of Public Lamps.	Gas Consumption per Annum.		Equivalent C.P.	Candle Hours per C.Ft. of Gas Consumed.	Remarks.
		C.Ft.	Therms.			
1899 .	20,998	478	2·68	280,000	2·5	Flat flame burners throughout district.
1902 .	21,800	359	2·01	1,190,000	14	Upright incandescence burner throughout district.
1913 .	24,713	371·5	2·08	1,700,000	19	8000 upright burners replaced by inverted burners.
1930 .	24,529	384·7	2·15	2,290,000	25	Inverted preheater cluster burners in general use.

It will be seen that whereas in 1899 the streets of South London were illumined with the equivalent of 280,000 candles, in 1902 the value had increased to 1,190,000 candles with an increase of only 4 p.ct. in the number of lamps and a decrease of approximately 25 p.ct. in the total annual gas consumption. The extension of the system of lighting by inverted incandescent burners was temporarily interrupted during the war, but the work has within the last ten years, been taken up again, and still greater efficiencies and reduction of costs have been realized by the more general use of the inverted incandescent burner, more especially of the preheated cluster type. The year 1930 marks the introduction of high-pressure gas lamps for the public lighting of main roads in South London. Within recent years, when, as has been so aptly stated, "motor cars have increased by leaps and bounds and pedestrians have progressed in the same manner" it was quickly realized that main thoroughfares under the prevailing altered condition of traffic required separate and individual consideration if they were to be effectively and adequately illumined. How should they be illumined? The South Metropolitan Gas Company was asked by the Lewisham Borough Council to install a gas-lighting installation over a test mile at Lewisham High Street in competition with a lighting installation to be erected, over a similar length of road, to be installed by the Electric Supply Company operating in this borough.

The South Metropolitan Gas Company installed a centrally suspended high-pressure gas-lighting system over the test mile, and the system was accepted by the Lewisham Borough Council as the standard system to be adopted for the lighting of all main streets over 50 ft. wide within the borough. Their example has since been followed by other boroughs within the Gas Company's area of supply, and already extensive centrally suspended high-pressure gas lighting installations, having a total length of about 11 miles, have been erected in the boroughs of Deptford, Greenwich, Lambeth, Lewisham, and Wandsworth.

The revision of the Company's public lighting, which is at present in hand, comprises *inter alia* the introduction of directional gas-lighting units and the use of special lamps at traffic control points.

GAS BURNER CONSTRUCTION.

The supply of gas by the South Metropolitan Gas Company is statutorily controlled by the South Metropolitan Gas Act, 1920, in accordance with which the Company supplies gas of constant declared calorific value equivalent to 560 B.Th.U. per c.ft. Such enactment and a similar enactment relating to constancy of declared calorific value contained in the Gas Regulation Act, 1920, which controls the supply of gas in Great Britain generally, considerably simplifies the matter of public lighting by gas in this country. Whatever the declared calorific value of the gas supplied, obligation is laid upon the gas supply undertaking to see that burners in which gas is consumed are such that the gas is burned so as to render an efficient duty. Gas and burner constitute a unit which must be suitably adjusted to one another so that the consumption of a definite amount of gas results in the performance of a definite duty. This possibility of standardizing gas-consuming appliances is one of the advantages accruing to the Gas Industry under the Acts; it sets the matter of public lighting by gas upon an exact quantitative basis, and produces a state of affairs eminently satisfactory both to public lighting authorities and to the suppliers of gas. The half-hearted attempts which were formerly made to cope with changes in the composition and properties of gas by the provision of devices for the adjustment of the rate of supply of gas to the burner, and for controlling the induced primary air current were never very successful. Such devices are now quite unnecessary as gas burners can once and for all be suitably designed, in the first place, for use with gas of the declared calorific value—that is to say, gas burners can now have as fixed and definite a construction as electric lamps. This fundamental principle of fixed gas and air was adopted by the South Metropolitan Gas Company at the suggestion of Dr. Charles Carpenter in about 1912 and has been adhered to ever since. The principle is incorporated in all burners supplied by the Company, whether for street lighting or any other purpose. The Company also early realized that efficient gas lighting is possible only when efficient gas-lighting appliances are used; shoddy inefficient burners—and their number is legion—can only discredit the Gas-Lighting Industry. Realizing this, the South Metropolitan Gas Company has given very considerable attention to the construction and testing of incandescence burners, in connection with the construction of the smaller types of lighting units employed for street lighting.

[The paper then proceeds to recount the research work carried out in connection with the manufacture of "Metro" burners. This work was described and illustrated in a paper, by the Public Lighting Department of the Company, published in the "JOURNAL" for Sept. 10, 1930, p. 579.]

STREET LIGHTING.

Within the last two years the South Metropolitan Gas Company has been engaged in re-lighting considerable parts of the roads within its area of supply. The extensive experience gained in this connection served to emphasize the need for a street-lighting specification acceptable and helpful both to the public lighting authority and to the gas supply Company. Pioneer work in the matter of drafting a street-lighting specification was done by Trotter in 1913, and a British Standard Specification for Street Lighting* was issued by the British Engineering Standards Association in 1927. Knowledge of the existence of this latter specification is slowly filtering through to public lighting authorities and supply companies. Features of this specification that require emphasis are (1) that the classes of street illumination included within the specification are based upon a minimum illumination, ranging from 0·01 ft.-candle in Class H to 2·0 ft.-candle in Class A, at a test point situated as far as possible from the sources constituting a complete unit of the system, (2) that in most cases, as will be seen by reference to Appendix II. of the specification, the test point is situated at the edge of the kerb, (3) that the specification takes no account whatever of average illumination of the roadway, and (4) that the classes do not necessarily represent the relative merits of the installations.

Our re-organization of the street lighting of South London and the development of highly directional systems of street lighting, with which we have been in keen competition in South London during this re-organization, suggest the necessity for a revision of the specification, in which the average illumination of the roadway shall be considered as at least equal, if not greater in importance, to a minimum illumination at a test point, situated, in most cases, at the edge of the kerb. Let us examine the matter a little in detail. Consider then a street-lighting unit, comprising two lighting units of candle-power C (supposed uniform in all directions), mounted at a height h and separated by a distance $D = 2d$ (see fig. 1). The illumination at the test point P equidistant from L and L' due to the two light sources considered is equal to

$$2C\cos\theta/(h^2+d^2) = \frac{2Ch}{(h^2+d^2)^{\frac{3}{2}}} = I_p, \text{ say.}$$

Calculation shows that the illumination at P due to pairs of succeeding lamps is, in the case of a practicable installation, of the order of 5 p.ct. of that due to L and L', and this is probably outside the order of accuracy of street illumination measurement. We may therefore take

$$I_p = \frac{2Ch}{(h^2+d^2)^{\frac{3}{2}}} \quad \ldots\ldots\ldots \quad (1)$$

Now for the best mounting height h of the units we require

$$\frac{dI_p}{dh} = 0,$$

which gives, after a little algebraic reduction,

$$h = d/\sqrt{2} \quad \ldots\ldots\ldots \quad (2).$$

* British Engineering Standards Specification No. 307, 1927.

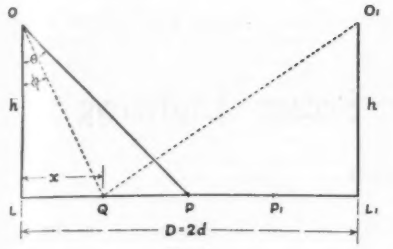


Fig. 1.

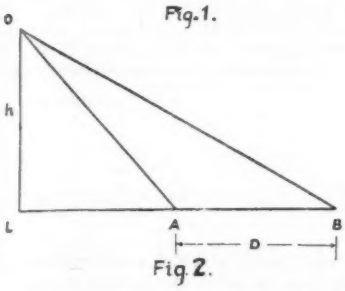
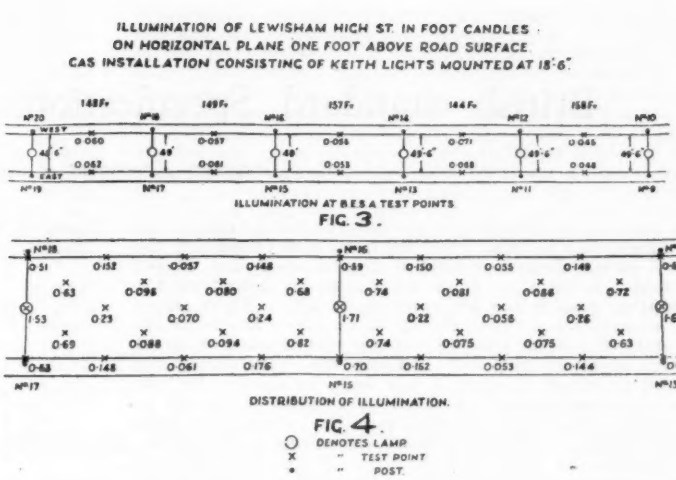


Fig. 2.


ILLUMINATION OF LEWISHAM HIGH ST. IN FOOT CANDLES
ON HORIZONTAL PLANE ONE FOOT ABOVE ROAD SURFACE.
GAS INSTALLATION CONSISTING OF KEITH LIGHTS MOUNTED AT 18'-6".
ILLUMINATION AT B.E.S.A. TEST POINTS.
FIG. 3.
DISTRIBUTION OF ILLUMINATION.
FIG. 4.
DENOTES LAMP.
" TEST POINT.
" POST.

In the case of a usual type of installation, for which $D\ (=2d) = 150$ ft., this would give h_m, the best mounting height for maximum illumination at the test point, ignoring absorption, the value $75/\sqrt{2} = 53$ ft. This is, of course, a wholly impracticable height, but the result indicates that illumination at the test point can be *increased* by *increasing* the mounting height of the units very considerably. Any increase of mounting height, however, clearly reduces the average illumination of the roadway. A very simple calculation, applied to the case illustrated in fig. 1, shows how the *average* illumination of the strip LL' depends on the mounting height h.

Considerations of symmetry indicate that the average illumination, I_a, over

$$LL' = 2\left[\int_0^D C\cos\phi\ dx/OP^2\right]\Big/D.$$

Or, since $x = h\tan\phi$,

$$I_a = (2C/Dh)\int_0^{\tan^{-1}D/h}\cos\phi d\phi = (2C/Dh)\left[\sin\phi\right]_0^{\tan^{-1}D/h}$$

$$= (2C/Dh)\,(D/OL') = 2C/h.OL' \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3).$$

This simple expression is a particular case of the more general expression for the average illumination over the strip AB (see fig. 2) due to a light source at O, viz.:

$$I_{\text{MEAN }(AB)} = (C/Dh)\,[LB/OB - LA/OA] \quad . \quad . \quad . \quad (4).$$

This expression enables the effect of neighbouring lamps upon the average illumination of a strip between two adjacent lamps to be readily calculated.

Expressions (1), (2), and (3) clearly indicate how an increase of mounting height operates in opposite directions so far as the illumination at the test point and average illumination are concerned, for while an increase of h up to the value $d/\sqrt{2}$ increases illumination at the test point, such increase of mounting height is seen from (3) to decrease the average illumination. Clearly then both test point and average illumination require to be taken into account in a specification of street lighting.

This matter of average as contrasted with B.E.S.A. test point illumination was of considerable importance in the matter of the illumination of a test mile of road in the Borough of Lewisham. Here, in 1930, adjacent test-mile lengths of road were illuminated by gas and by electricity respectively. Tests of the illumination of the roadway provided by the gas installation, comprising a series of centrally suspended 1000 c.p. high-pressure lamps, were made by the National Physical Laboratory, and part of the results are given in figs. 3 and 4. The results of these measurements may be briefly summarized as follows:

Illuminant	Centrally suspended 1000 C.P. high-pressure gas lamps
Mounting height of lamp above roadway	18 ft. 6 in.
Average distance between successive lamps	151 ft.
Spacing/height ratio	8·2
Average width of roadway	49 ft. 2 in.
Average illumination at B.E.S.A. test point	0·058 f.c. (α)
Average illumination at B.E.S.A. test point calculated by formula (1)	0·056 ,, (α')
Average illumination of roadway—	
(N.P.L.) 43 readings in 2 spans	0·401 ,, (β)
(S.M. Gas Co.) 36 readings in 2 spans	0·408 ,, (γ)
Average illumination along line of lamps	0·66 ,, (δ)
Average illumination along line of lamps calculated by formula (3)	0·68 ,, (ϵ)
Average illumination along line of lamps calculated by formula (4)	0·70 ,, (ζ)

Results (α) and (α') confirm the validity of formula (1). A comparison of experimental results (β) and (γ) show that, within the limit of experimental error, the number of test points necessary to obtain the average illumination of a roadway is not excessive. The result of 43 readings and 36 readings made on different occasions by the National Physical Laboratory and the South Metropolitan Gas Company differ only by less than 2 p.ct.

Results (δ), (ϵ), and (ζ) confirm the validity of the formulæ (3) and (4).

Within recent months the Company has been engaged in re-lighting portions of the highways within its area.

For purposes of classification, roads have been divided into four classes—viz.:

Class (1). Main roads, being, in general, *both* tram and 'bus routes.

Class (2). Main roads, being, in general, *either* 'bus or tram routes.

Class (3). Roads carrying considerable fast traffic, exclusive of trams and 'buses.

Class (4). Side roads, exclusive of cul-de-sacs.

The lamps generally used for the illumination of these roads are:

Class (1). Either high-power high-pressure lamps spaced 50 yards apart and at height of 18 ft., in the case of main arterial roads, or 6-8 No. 2 mantles low-pressure lamps, spaced at 50 yards and at a height of 14 ft. 6 in.

Class (2). 4 No. 2 mantles low-pressure lamps, spaced 50 yards apart and at a height of 13 ft. 6 in.

Class (3). 3 No. 2 mantles low-pressure lamps arranged as in Class 2.

Class (4). 2 No. 2 mantles arranged as in Class 2.

C.P. and Consumptions (including By Pass.)

	C.P. Candles.	Hourly Consumption. C.Ft.	Hourly Consumption. Centi-therms.
2 No. 2 in 14-in. Windsor lantern	170	5·5	3·08
3 No. 2 in 16-in. Windsor lantern	250	7·0	3·92
4 No. 2 in South London lantern	370	10·0	5·60
6 No. 2 Cradle lamp	550	15·5	8·7
8 No. 2 Cradle lamp	640	20·5	11·5
Police Traffic Control Points.			
12 No. 2 Cradle lamp	960	28·5	16·0
15 No. 2 Cradle lamp	1000	35·0	19·6
High pressure	1000	20·5	11·5
,,	1500	31·0	17·4

The novel features of these lamps are:

(1) The use of reflecting mirrors of silvered glass, "stainless" or chromium plated steel, to effect an improved distribution of illumination on the roadway.

(2) The enclosure of the pressure governor and clock controller within a case at the base of the lamp.

The respective candle power and consumptions of the lamps employed are given herewith. In the case of lamps employed for the illumination of police traffic-control points, a reflector distributing the light over an appropriate circular area is employed and has been found very effective. Mirrors are arranged to reflect some of the light through red glass to act as warning of approach to a control point.

British Standard Specification for Street Lighting

C. C. Paterson, President of the Congress

At the Saranac Meeting of the International Commission on Illumination in 1928, I had the honour of presenting the newly issued British Standard Specification for Street Lighting. I did this as its Chairman on behalf of the Committee responsible for drawing it up. Three years have elapsed since then, during which there has been opportunity of gauging the effect of this specification on street lighting in Great Britain. During the same period the Committee which drafted it has been in session for the purpose of considering in what particulars it should be amplified or amended, and this year the revision has been issued. Before mentioning those directions in which the specification has been revised, I should like to make one or two general observations on the practical results of the 1928 specification. They may be summed up as follows:

(1) It has been very widely used for the purpose of describing and classifying existing installations.
(2) This has often had the effect of drawing attention to the low illumination of the streets in certain districts, and causing steps to be taken for improvement.
(3) It has been fairly extensively used where new installations have been projected, and has served the chief purpose expected of it—that of affording a classification of streets in terms of illumination. On the above grounds alone the Committee considers that the specification has justified itself; but in addition to this it is establishing a high standard in the design and in the requirements of street lighting. There are certain criticisms of the practical working of the specification which the Committee has remarked upon.
(4) It has not been possible entirely to prevent lighting authorities from giving exaggerated attention to the test point illumination to the exclusion of other factors which make for good lighting—with the object thereby of jockeying an installation into the next "class" of the specification, under the impression that the various classes represent an order of merit.
(5) Where minimum figures for mounting height have been given, there has been a tendency for these to be taken as heights which it is not worth while exceeding, whereas the Committee had hoped that in practice they would usually be exceeded.
(6) For many cases in which the lamp posts are on one side of the road only—in which event it is inherently difficult to produce a satisfactory installation—it has not been found that the prescribed minimum mounting heights are sufficient.

In the light of this experience the Committee has recommended certain additions to the 1927 issue of the specification, and these have been embodied in a revised edition issued this year.

Taking points (4), (5), and (6) seriatim the following steps have been taken to obviate these drawbacks.

When the only information about a street is its minimum (or test point) illumination, there is a tendency to appraise as well as to classify the street by this standard—to use minimum illumination as a criterion of excellence instead of, as intended, a method of grouping streets. British Standard Specifications never have two grades of excellence for one and the same purpose. As I explained in my paper on the British Specification, in Saranac in 1928, it is for the lighting authority to decide which "class" of street lighting installation is suitable for any particular roadway. Each class, from "A" to "H," was expected to have its application to some category of roadway, but the decision as to which one was left to the lighting authority. So far, in broad principle, the intention has been carried out. But it is possible by extreme concentration of light on a test point, and with very wide pole spacings, to produce a type of lighting which will put an installation (say) in Class F, but in which the total amount of light on the roadway and general effectiveness is less than in another street whose test point illumination puts it in Class G.

But it is recognized that, as a general rule, for a given test point illumination and mounting height, the greater the spacing—height ratio the worse the installation, and it has been considered wise to lay down maximum values for this variable. The following table has, therefore, been added, which gives the maximum permitted and recommended maximum spacing—height ratios in the various classes.

Table I.

Class.	Maximum.	Recommended Maximum.
A	5	Not more than 3
B	6	,, ,, ,, 4
C	8	,, ,, ,, 5
D	9	,, ,, ,, 6
E	10	,, ,, ,, 7
F	12	,, ,, ,, 8
G	12	,, ,, ,, 10
H	12	,, ,, ,, 10

Furthermore, the specification is not concerned with the relative merits of the two installations quoted above. The knowledge of the art has not developed sufficiently to say definitely which is the better, but to this extent the Committee agrees with the opinion expressed by other countries at Saranac, that average illumination should have some place in systems of classification of street lighting installations. It was considered, therefore, that the purchaser of an installation, in addition to knowing that it comes within the class he prescribes (on the basis of minimum illumination), should also know what is the total light falling on the roadway—or, in other words, what is the average illumination. So that if he has occasion to judge between two schemes for lighting a street within a particular class, he shall also have before him the figures of average illumination in the two cases. A requirement has therefore been inserted that with any tender there shall be given the value of the maximum and average illumination on the roadway. The average illumination to be calculated by a method to be agreed by the purchaser.

The great difficulty which the British Committee has hitherto felt in using average illumination as a test requirement is the difficulty of its practical measurement. For the purpose, however, of supplying information with the tender, as to average illumination, it is not necessary to give data as measured in the street. Such particulars are best obtained by calculation from the candle power distribution data of the fitting.

It was not considered that the method of determination of average illumination under this clause should be left to the tenderer to decide, because considerable divergencies may result unless care is taken to use a sound method. While the method is to be agreed with the purchaser, the specification recommends calculating average illumination by the use of the iso candle diagram first put forward by Benford.

The method simplifies the calculation, and when a given lighting unit is to be used for a number of installations there is a graphical procedure which eliminates much of the work of calculation which would be otherwise involved.

As explained above, the mounting heights for light sources were defined in the 1927 specification as minima; but this has had the practical result which so often follows—that the minimum height has been accepted as a sufficient and adequate height. To obviate this, the Committee has inserted for each class, in addition to the old figure of minimum, a figure of recommended height. The table in question now stands thus:

Table II.

Class.	Rated Mean Test Point Illumination on Roadway.	Height of Luminous Centre of the Light Source above the Ground.	
		Minimum.	Lowest Recommendation.
	Foot Candles.	Ft.	Ft.
A	2·0 and upwards	30	30
B	1·0	25	28
C	0·5	21	25
D	0·2	18	21
E	0·1	15	18
F	0·05	13	15
G	0·02	13	13
H	0·01	Preferably 13	13

Experience has shown the ineffectiveness of street illumination when relatively low posts are arranged on one side of the street only. The brightness of the street surface on

the side of the highway remote from the posts is very low—and the glare is liable to affect visibility. It was therefore decided to prescribe that the height of the posts must not be less than two-thirds of the width of the roadway. For normal widths of roadway this helps towards relative immunity from glare, and for abnormal road widths it ensures lighting on both sides.

There is a further particular in which the 1927 issue has been revised. A graphical method of assessing the glaring effect of an installation was originally worked out on the basis of the experimental work of Bordoni, and was included as an appendix to the specification, it being required that the tenderer should state the glare figure determined in accordance with the methods given.

The glaring effect of an installation is a factor of considerable importance, and is not to be neglected; but it is inherently a complicated matter to express numerically, and any such calculation involves practically every variable in the installation. It was found, in consequence, that even the simplified method given in the specification was considered by many of its users to be too involved and was not being used; and, furthermore, later experimental work by Stiles demonstrated that certain asumptions made in the method given gave rise to errors larger than had been anticipated. Other and better methods have been devised, but so far it has not been possible to find a method of evaluating glare which does justice to our more complete knowledge of the subject and is at the same time of a nature suitable for insertion in a specification. In the revision, therefore, no numerical expression of glare has been used, but guidance is offered to the users of the specification as to the means by which glare may be mitigated.

Notes on Recent Developments in Gas for Street Lighting in Great Britain as Illustrated by the Facts Relating thereto in the Cities to be Visited by Delegates to the International Illumination Congress

Sir Francis Goodenough, C.B.E., Chairman of the British Commercial Gas Association

The following notes, based upon data provided by the Institution of Gas Engineers, give some particulars relating to the gas lighting of the streets in the cities to be visited by the delegates to the International Illumination Congress. Gas is used for lighting the great majority of the streets in this country, and some 635,000 gas lamps are in use to-day in the streets of England and Wales. Some idea of the proportion of gas lamps to other lamps throughout the country may be gained from the results of a recent survey into some part of the public lighting. It was shown that in 318 cities and towns no less than 13,341 (80 p.ct.) of the total of 16,559 miles are lighted by gas. Both high and low pressure lighting is employed. Low pressure is more generally used than high pressure, doubtless because recent improvements in the former have rendered it unnecessary to increase the use of high-pressure mains. The most notable advance in the application of low-pressure lighting is the introduction of the superheated cluster burner, many examples of which will be seen by delegates in the various towns included in the tour.

The position in regard to the use of gas under pressure for street lighting is, in fact, that there has been little increase in its use in recent years in the cities of Great Britain, except for the installation of 15 additional lamps in Regent Street, London, in 1930, and of some 300 centrally-hung lamps for the lighting of many of the main

Table I.—*London. The Gas Light and Coke Company.*

Location	Cannon Street.	Pall Mall.	Piccadilly.	Queen Victoria Street.	Regent Street.	Victoria Street.	Whitehall.
1. Description of lamp	2-lt. Keith Blackman high pressure lamps	2-lt. Keith Blackman high pressure lamps on columns	2-lt. Keith Blackman high pressure lamps on columns	2-lt. Keith Blackman high pressure lamps	2-lt. Keith Blackman high pressure lamps on columns	2-lt. Keith Blackman high pressure lamps on columns	2-lt. Keith Blackman high pressure lamps on columns
2. Gas usage per hour	40 c.ft.	40 c.ft.	40 c.ft.	40 c.ft.	40 c.ft.	40 c.ft.	40 c.ft.
3. Arrangement of lamps	Lamps are suspended over the centre of the road on traversing and lowering gear	Staggered system with some refuge columns	Lamps along centre of roadway only	Lamps arranged on staggered system with refuge columns along the centre of the road	A line of refuge columns along the centre of the road and columns on kerb line	Lamps are arranged on the staggered system along the kerbways, also refuge lamp columns are in use	The staggered system is employed with refuge lamps at necessary points
4. Width of carriageway	30 ft. 6 in. kerb to kerb	44 ft.	50 ft.	44 ft. 6 in.	50 ft. kerb to kerb	40 ft. 6 in. kerb to kerb	85 ft. kerb to kerb
5. Average distance between lamps	100 ft.	172 ft.	174 ft.	78 ft.	87 ft.	125 ft.	95 ft.
6. Average distance to specification testpoint	53 ft.	90 ft.	90 ft.	53 ft.	66 ft.	68 ft.	85 ft.
7. Height of light source	26 ft.	20 ft.	21 ft.	20 ft. 6 in.	21 ft.	20 ft.	20 ft.
8. Spacing-height ratio (Nos. 5–7)	3·8	9	8·3	3·8	4·2	6·2	4·8
9. Horizontal illumination—Minimum footcandle at test point	0·76	2·20	2·0	3·0	3·6	2·3	3·0
10. Horizontal illumination—Maximum footcandle	0·246	0·116	0·134	0·568	0·46	0·23	(*a*) 0·41 near Cenotaph (*b*) 0·60 near Parliament Square
11. Horizontal illumination—Average footcandle over area illuminated, if obtainable	..	..	..	..	..	..	..
12. Ratio—Minimum to maximum illumination	..	1·9	15	5·3	7·8	10	6
13. B.E.S.A. specification class	D	E	E	D	D	D	D and C
14. Is illumination free from "objectionable glare" (see Specification Clause 16)?	..	..	..	..	..	..	..
15 General remarks, if any	..	..	..	..	..	..	..
16. Candle power at source	2000	1800	1800	2000	2000	1800	1800

TABLE II.—*London. The Gas Light and Coke Company.*

Location	Bayswater Road.	High Street, Bloomsbury.	Jermyn Street.	Kensington Road.	Oxford and Cambridge Terrace.	Seven Sisters Road.	Tottenham Court Road.	Vauxhall Bridge Road.
1. Description of lamp (*e.g.* square lantern; preheater with *x* No. 2 nozzles in line (or cluster); "Rochester" 10-lt. No. 2 mantles, &c.)	Suspension lighting, "Rochester" 10-lt. suspension lamps with 30 in. reflectors and half frosted globes. Medium mantles	"Kemborn" 6-lt. line burner globe lamps	Circular "Nico" lanterns with 6-lt. cluster burners with long bijou mantles	Circular "Nico" lanterns with 6-lt. long bijou cluster burners	Circular lanterns with 3-lt. bijou cluster burners	12-lt. "Rochester" suspension lamps with long bijou mantles	Globe lamps with 16-lt. cluster burners	Circular "Nico" lanterns with 6-lt. long bijou cluster burners
2. Gas usage per hour	25 c.ft.	12 c.ft.	12 c.ft.	12 c.ft.	4·5 c.ft.	24 c.ft.	32 c.ft.	12 c.ft.
3. Arrangement of lamps (*e.g.* staggered; double side, one side or central spacing)	Central suspension	Staggered	Staggered	Staggered	Staggered	Staggered	Staggered	Staggered
4. Width of carriageway	47 ft. 6 in.	21 ft.	21 ft. 7 in.	46 ft.	41 ft.	48 ft.	31 ft. 3 in.	40 ft.
5. Average distance between lamps	116 ft.	70 ft.	62 ft.	68 ft.	61 ft.	180 ft.	50 ft.	88 ft.
6. Average distance—to specification test point	62 ft.	37 ft.	35 ft.	57 ft.	33 ft.	93 ft.	30 ft.	50 ft.
7. Height of light source	20 ft.	14 ft.	14 ft.	14 ft. 10 in.	11 ft.	18 ft. 6 in.	17 ft. 6 in.	14 ft. 10 in.
8. Spacing - height ratio (Nos. 5–7)	5·8	5·5	4·7	5·6	6·75	9·8	3·4	8·7
9. Horizontal illumination—Minimum footcandle at test point	0·092 service measurement	0·15 service measurement	0·15 service measurement	0·048 service measurement	0·030 service measurement	0·044 service measurement	0·37 service measurement	0·046
10. Horizontal illumination—Maximum footcandle	1·78	1·64	1·22	0·73	0·69	2·46	2·1	0·83
11. Horizontal illumination—Average footcandle over area illuminated, if obtainable	0·49	Not known	Not known	Not known	Not known	Not known	Not known	Not known
12. Ratio—Minimum to maximum illumination	19·4	10·9	8·1	15·2	23	55	5·6	18
13. B.E.S.A. specification class	E	E	E	F	G	G	D	G
14. Is illumination free from "objectionable glare" (see Specification Clause 16)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
15. General remarks, if any	This is a 1930 installation. At present there are 23 lamps in service, and it is expected that this number will be increased	The illumination of a road by "Line" burners is an example of modern development in street lighting by low-pressure gas lamps	..	..	Very even illumination of the roadway, with absence of patchiness	..	Very uniform lighting with entire absence of patchiness and exceptionally low diversity ratio	..

TABLE III.—*London. South Metropolitan Gas Company.*

Location	Upper Tooting Park.	Bedford Hill.	Mitcham Lane.	Streatham High Road and Streatham Hill.	Lewisham High Road.
1. Description of lamp (*e.g.*, square lantern; preheater with *x* No. 2 nozzles in line (or cluster); "Rochester" 10-lt. No. 2 mantles, &c.)	14 in. Windsor square. Preheater with two No. 2 mantles cluster	16 in. Windsor square. Three No. 2 preheater	S. London lantern, circular. Preheated with four No. 2 cluster	Cradle lamp, 6-lt. No. 2 preheater, directional reflectors. Police traffic control lamps	High-pressure centrally suspended 1000 C.P.
2. Gas usage	5·5 c.ft. per hour	7 c.ft. per hour	10 c.ft. per hour, including by-pass	15·5 c.ft. per hour	20 c.ft. per hour
3. Arrangement of lamps (*e.g.*, staggered; double side, one side or central spacing)	Staggered	Staggered	Staggered	Staggered	Centrally suspended
4. Width of carriageway	40 ft.	15–30 ft.	35 ft.	50 ft. (average)	49 ft. 6 in.
5. Average distance between lamps	150 ft.	150 ft.	130 ft.	120 ft.	150 ft.
6. Average distance—to specification test point	80 ft.	75 ft.	75 ft.	70 ft.	80 ft.
7. Height of light source	13 ft. 6 in.	13 ft. 6 in.	13 ft. 6 in.	13 ft. 6 in.	18 ft. 6 in.
8. Spacing-height ratio (Nos. 5-7)	11·1	11·1	9·6	8·9	8·1
9. Horizontal illumination—Minimum footcandle at test point	0·01	0·014	0·020	0·044	0·060
10. Horizontal illumination—Maximum footcandle	..	..	..	..	1·71
11. Horizontal illumination—Average footcandle over area illuminated, if obtainable	..	..	..	..	0·436
12. Ratio—Minimum to maximum illumination	..	..	..	..	..
13. B.E.S.A. specification class	H	H	G	F–G	F
14. Is illumination free from "objectionable glare" (*see* Specification Clause 16)?	Yes	Yes	Yes	Yes	Yes
15. General remarks, if any	..	..	..	..	..

TABLE IV.—*London. Tottenham and District Gas Company.*

	Gt. Cambridge Arterial Road.
1. Description of lamp (*e.g.*, square lantern; preheater with *x* No. 2 nozzles in line (or cluster); "Rochester" 10-light, No. 2 mantles, &c.)	6-light, No. 2 mantles (cluster burners), upright fixing. Rochester lamps fitted with 3 and 2 tier "Staybrite" reflectors
2. Gas usage per hour	..
3. Arrangement of lamps (*e.g.*, staggered; double side, one side, or central spacing)	Staggered
4. Width of carriageway	24 ft.
5. Average distance between lamps	118 ft.
6. Average distance—to specification test point	60·6 ft.
7. Height of light source	16 ft. above ground level
8. Spacing-height ratio (Nos. 5–7)	7
9. Horizontal illumination—Minimum footcandle at test point	0·100
10. Horizontal illumination—Maximum footcandle	(At 20°) 1·94 (*i.e.*, 5·75 ft. from post)
11. Horizontal illumination—Average footcandle over area illuminated, if obtainable	Not available
12. Ratio—Maximum to minimum illumination	19·4
13. B.E.S.A. specification class	E
14. Is illumination free from "objectionable glare" (see Specification Clause 16)?	Yes
15. General remarks, if any	..

roads in the south-east of London. Full particulars of the latter will be found in the paper presented by Dr. Thomas on behalf of the South Metropolitan Gas Company.

The high-pressure gas lamps which were installed in 1910 in the City of London in the following thoroughfares:

1 of	500	C.P.	in Fleet Street (column lamp)
3 ,,	2000	,,	,, ,, ,,
11 ,,	2000	,,	,, (centrally hung lamps)
1 ,,	500	,,	New Bridge Street (column lamp)
6 ,,	2000	,,	,, ,, ,,
41 ,,	2000	,,	Queen Victoria Street ,, ,,
2 ,,	2000	,,	Cannon Street ,, ,,
11 ,,	2000	,,	,, (centrally hung lamps)
8 ,,	2000	,,	Monument Street ,, ,,
1 ,,	2000	,,	Lower Thames Street (column lamp)
4 ,,	2000	,,	,, ,, (centrally hung lamps)

and in 1910 in the City of Westminster in the following thoroughfares:

16 of	2000	C.P.	in Regent Street (column lamps) } increased to 31 of
1 ,,	1000	,,	,, ,, ,, } 1800 C.P. in 1930
13 ,,	1800	,,	Aldwych (column lamps)
3 ,,	1800	,,	Coventry Street ,, ,,
5 ,,	1800	,,	Cambridge Circus ,, ,,
5 ,,	1800	,,	Charing Cross Road ,, ,,
2 ,,	1800	,,	Haymarket ,, ,,
7 ,,	1800	,,	Kingsway ,, ,,
3 ,,	1800	,,	Leicester Square ,, ,,
4 ,,	1800	,,	Northumberland Avenue ,, ,,
11 ,,	1800	,,	Parliament Street ,, ,,
7 ,,	1800	,,	Parliament Square ,, ,,
10 ,,	1800	,,	Piccadilly and Piccadilly Circus (column lamps)
3 ,,	3000	,,	,, ,, ,, ,, ,,
12 ,,	1800	,,	Pall Mall ,, ,,
4 ,,	1800	,,	Lower Regent Street ,, ,,
8 ,,	1800	,,	Sanctuary ,, ,,
8 ,,	1800	,,	St. James' Street ,, ,,
11 ,,	1800	,,	Shaftesbury Avenue ,, ,,
4 ,,	1800	,,	Trafalgar Square ,, ,,
24 ,,	1800	,,	Victoria Street ,, ,,
15 ,,	1800	,,	Whitehall ,, ,,
1 ,,	1000	,,	,, ,, ,,
4 ,,	1800	,,	Waterloo Place ,, ,,
7 ,,	1800	,,	Wellington Street ,, ,,

continue in use to-day and have been observed by the delegates in their tour of inspection in London. It may be mentioned that there are altogether over 96,000 gas lamps in use in the streets of London and its environs. From these figures it will be seen that the great bulk of the lamps are on the low-pressure system.

The high-pressure gas lamps in use in *Birmingham* number 43 of 4500 C.P. each and are to be found in the following thoroughfares: Stephenson Place, Victoria Square, and Paradise Street.

Data relating to the street lighting of Birmingham both high and low pressure, will be found in the Appendix. Of Birmingham's 666 miles of streets, 660 are lighted by gas.

There are no high-pressure gas lamps in use in *Glasgow*, as those formerly in use were discarded during the war (when street lighting was of necessity reduced to a minimum), and have not yet been brought again into action. On the other hand, the low-pressure gas lamps number over 26,000.

In *Cambridge* the gas lighting (which is very general in the town) is by low pressure, and the installation includes

TABLE V.—*Birmingham.*

Location	—	—	Hagley Road Section. Gas. Double.	Paradise Street.	Victoria Square.
1. Description of lamp (*e.g.*, square lantern; preheater with *x* No. 2 nozzles in line (or cluster); "Rochester" 10-lt. No. 2 mantles, &c.)	"Rochester" 8-lt. No. 2 mantles. Reduced to 2-lt. at midnight	"Rochester" 8-lt. No. 2 mantles. Reduced to 2-lt. at midnight	"Rochester" 8-lt. No. 2 mantles. Reduced to 2-lt. at midnight	Special three burner (each 1500 nominal C.P.) high pressure, our own construction. Total nominal C.P. each lamp, 4500	Special three burner (each 1500 nominal C.P.) high pressure, our own construction. Total nominal C.P. each lamp, 4500
2. Gas usage	20 c.ft. per hour	20 c.ft. per hour	20 c.ft. per hour	90 c.ft. per hour each lamp	90 c.ft. per hour each lamp
3. Arrangement of lamps (*e.g.*, staggered; double side, one side or central spacing)	Staggered	Central spacing	Double side	Central spacing	General scheme is double side lighting, but lamps are arranged in and around the Square
4. Width of carriageway	34 ft. Columns set 1 ft. back. Arms overhang 4 ft. Width between lamps, 28 ft.	34 ft.	34 ft. Columns set 1 ft. back. Arms overhang 4 ft. Width between lamps 28 ft.	Average 41 ft. 6 in.	..
5. Average distance between lamps	123 ft.	40 yds.	40 yds.	Average 58 ft.	..
6. Average distance—to specification test point	63·2 ft.	62·5 ft.	61·5 ft.	Average 35 ft. 6 in.	..
7. Height of light source	18 ft. 6 in.	18 ft. 6 in.	18 ft. 6 in.	Average 26 ft. 6 in.	19 ft.
8. Spacing-height ratio (Nos. 5-7)	6·6	6·5	6·5	2·2	..
9. Horizontal illumination—Minimum footcandle at test point	0·054	0·07	0·143	Average of six minimum test point observations 2·2	Average of four minimum test point readings 2·37
10. Horizontal illumination—Maximum footcandle	2	2·0	2·0	4	..
11. Horizontal illumination—Average footcandle over area illuminated, if obtainable	0·38 by Jolley and Waldram formula	0·485 by Jolley and Waldram formula	0·91 by Jolley and Waldram formula	2·3 by Jolley and Waldram formula	..
12. Ratio—Minimum to maximum illumination	37	28·6	14	1·8	..
13. B.E.S.A. specification class	F	F	E	A	A
14. Is illumination free from "objectionable glare" (*see* Specification Clause 16)?	Yes	Yes	Yes	Yes	Yes
15. General remarks, if any	The above-mentioned figure of illumination at minimum test point has been doubled in the case of a few lamps by the adoption on them of special "Staybrite" reflectors. This brings it into Class E	The above-mentioned figure of illumination at minimum test point has been increased 50 p.ct. in the case of a few lamps by the adoption on them of special "Staybrite" reflectors. This brings it into Class E	The above-mentioned figure of illumination at minimum test point has been doubled in the case of a few lamps by the adoption on them of special "Staybrite" reflectors. This brings it into classification D	This is an exceptionally well lighted street, and the degree of illumination is far above normal requirements. It is an extension of the scheme of lighting in Victoria Square	Owing to the shape of the Square and the irregular spacing of the lamps, it is difficult to reply to all the questions as set out above. The scale of lighting in this area is altogether exceptional and is probably unequalled in Europe

certain direction, we subject ourselves to discomfort, we shall be reluctant to look in that direction; and although if we did do so, we should see objects, our reluctance to look reduces the probability of objects being seen. Furthermore, if we are subjected to discomfort glare continuously, unpleasant effects such as headaches are likely to follow, which must inevitably reduce our receptiveness to the visual impressions received by the eyes.

The disability glare produced by a lighting source has been shown experimentally to depend primarily on the illumination produced at the eyes of the observer by the lighting source in question, and to be practically independent of the brightness of the source provided the illumination at the eye is the same. It has also been shown that the nearer the light source to the direction of vision the greater the disability glare, and the higher the general level of brightness the less the disability glare, estimated always with the illumination at the eye kept constant. In a street lighting installation disability glare can be resolved into a contribution from the nearest lamp and contributions from distant lamps. The former will generally be greatest for highly directional fittings; it will be greater the lower the mounting height and it will increase with the spacing-height ratio. The disability glare from the distant lamps depends principally on the candle-power of the fittings in directions very close to the horizontal. The disability glare from the first lamp is considerably greater in centre suspension than in staggered or side lighting systems. The arrangement of the light sources has relatively little effect on disability glare from the distance sources.

Less is known of the factors determining discomfort glare. It appears certain, however, that for a fitting of given candle-power the discomfort glare will be greatest when the brightness is greatest, and it will also increase in passing to lower brightness levels. Although no definite information is available, it is possible that the colour of the light source may affect the degree of discomfort glare.

We proceed to analyze in the same way the second of the requirements under which the performance of street lighting installations is to be judged—namely, attractiveness by night. Obviously, in dealing with such a notion as attractiveness ordinary scientific methods of measurements cease to apply. Street lighting installations should be attractive, because there is a public demand for this attribute and because unattractive street lighting would inevitably lead to criticism and complaint. It follows that the standards by which attractiveness must be evaluated are based on collective personal opinion. The definiteness of such standards ranges from cases where for every person holding a certain view another holding the opposite view can be found, to cases where the great majority of people are in agreement. Naturally, it is only conclusions of the latter kind which illuminating engineers can hope to take into account. The following scheme will be useful in discussing attractiveness by night.

Attractiveness by night.

1. Brightness level.
2. Diversity of brightness.
3. Arrangement, brightness, and colour of light sources.

As in the case of revealing power, so for attractiveness by night a high brightness level is always to be desired. As regards the diversity of brightness, there is a large measure of agreement among observers that too low a diversity results in a dull and unattractive type of lighting. Again, this conclusion with respect to diversity probably ceases to be true if the brightness level is so high that the colours of objects and contrasts on or in the object can be perceived. The individual forming an opinion of the attractiveness of an installation gives as a rule most of his attention to the light sources. To avoid disability glare from the distant fittings, installations have been designed in which the light sources beyond the first are not visible to observers in the street. On this point, there is practically complete agreement, as far as the writers have been able to collect views, that the apparent absence of the distant light source gives unattractive street lighting. The most definite evidence for this conclusion was obtained in the experimental investigation of street lighting carried out at Leicester in 1930. The mounting height of the light sources in this case was only 18 ft. above ground level. Observations on an installation with a 25 ft. mounting height and spacing height ratio of 6 show that the displeasing effect of obscuring the distant light sources is much reduced. Other points connected with attractiveness by height and the arrangement of the light sources, such as the choice of staggered and centre suspension systems and the number of light sources per post, will be passed over here as of minor interest.

Connected with the presence or absence of the light sources in the field of view is the question of the brightness of the light source. It is certainly true that too bright light sources in a street lighting installation will produce discomfort glare. On the other hand, it appears that, to some observers, the very fact of having bright sources in the field makes for attractiveness in the installation. It is difficult to find out what is the general consensus of opinion on this point, but no doubt illuminating engineers should aim at reducing the apparent surface brightness of the light source to as low a value as is compatible with a reasonably cheerful appearance. This is a very indefinite prescription, but it appears to be the best available at present. The colour question is, of course, bound up with the choice between gas and electricity in street lighting. As, on the purely scientific side, there is no definite evidence that the greenish light of gas mantles is pleasanter or less pleasant than the more yellow light of the electric filament, the illuminating engineer is absolved from involving himself in controversy on this score.

Finally, we come to attractiveness by day. The above remarks about the essential difficulty of reaching a conclusion with respect to attractiveness by night apply in even greater force to the question of attractiveness by day. There are only one or two general remarks which the writers feel inclined to make here. The first is that fittings employing large opal or other diffusing glassware bowls or globes are more likely to give an attractive effect by day. Secondly, the use of fittings in which the optical parts, such as mirrors or prisms, are not grouped symmetrically about the light source is likely to result in unattractive appearance.

CLASS 1. *Arterial roads and generally roads joining one place to another, with no shop lights or other incidental lighting.*

For this type of road, revealing power is the sole consideration. In accordance with above discussion the requirements for this case would be as high a brightness level as possible (this is unlikely to be very high, however, owing to cost), some diversity, freedom from disability, and discomfort glare. Attractiveness is unimportant. It follows that cut-off fittings should be used to eliminate all glare from distant lamps. This can be effected if the polar curve of the fitting in the plane along the street drops to zero or to a very small value, for all angles between the horizontal and a line directed to a point 5 ft. above the ground at the next lamp-post. With fittings of this character (so-called cut-off fittings) no light reaches the eyes of an observer from any light source beyond the nearest lamp marking the end of the span in which he is standing. All glare from distant light sources is therefore eliminated. To keep disability glare from the first lamp low, the mounting height should be large and the spacing-height ratio small. Increasing the mounting height will decrease the brightness level on the roadway. This effect can be mitigated by the use of asymmetric fittings which concentrate the light along the roadway.

As regards the polar curve of the fitting in the plane along the street, we distinguish between non-directional fittings in which the candle-power is nearly the same for all directions up to the cut-off direction, and directional fittings in which the candle-power increases from a low value under the lamp to a high value pointing in the direction of the mid-point of the span or some similar point. Keeping the mounting height, the spacing-height ratio, and the average illumination the same, the more directional a fitting the greater the disability glare. Highly directional fittings are for this reason undesirable. The main purpose of such fittings is to keep a high minimum illumination and reduce diversity. As previously pointed out, some diversity is definitely desirable at fairly low levels of brightness such as are met with in the class of street under consideration. To sum up, the polar distribution of the fitting should conform to the cut-off requirements, should be non-directional or only weakly directional in the plane of the roadway, and, to economize light, should be of asymmetric type concentrating the light along the roadway instead of dispersing it to the sides.* To reduce discomfort glare the light source should be of relatively low brightness—that is to say, bare filaments must be avoided.

CLASS 2. *Residential streets not shopping centres.*

The requirements here are high revealing power (necessarily less than for Class 1) and attractiveness. The desirable lighting here, however, differs from that for Class 1 because sharp cut-off fittings must be rejected on account of the resulting unattractive appearance. Asymmetric fittings are also not to be recommended as they reduce the illumination falling on the houses along the street, and this

* Almost all asymmetric fittings at present in use are highly directional in the vertical plane parallel to the roadway, but there seems to be no reason why fittings should not be designed to re-direct on to the roadway light which would otherwise be lost, without at the same time concentrating this light at a particular angle and producing a directional effect.

is an important consideration in the lighting of streets of this type. In general, available mounting heights for this type are low, and it is therefore particularly important to avoid highly directional fittings which may produce disability glare.

CLASS 3. *Shopping centres and important city streets.*

A very high level of brightness is required so that when shop lights are extinguished the streets are not transformed into dimly lighted low grade streets. The mounting height will normally be large (25 to 30 ft.) and spacing small, so that, with the high brightness level demanded, revealing power can probably be assumed adequate. Freed from the necessity for eking out his light to give maximum revealing power, the illuminating engineer can, for this class of street, choose fittings which give the most satisfactory appearance to the street both by day and by night.

CLASS 4. *Spectacular lighting.*

There is no limit to the various devices which can be employed in the lighting of promenades and show places generally. The following suggestion indicates the principle on which the lighting of a promenade might be based. The lighting should consist of a combination of two systems, (*a*) relatively low-power diffusing bowl units closely spaced (50 ft. perhaps) and not too high (15 ft. perhaps), and (*b*) high-power cut-off fittings mounted at least 40 ft. up and less closely spaced. The (*a*) system is to give the impression of ample and cheerful lighting and to provide very high local illumination under the post. The (*b*) system raises the brightness level, reduces the diversity and eliminates patchiness, and ensures high revealing power free from glare.

Institution of Gas Engineers.

A London Illumination Tour has been arranged for members of the Institution and their guests (ladies or gentlemen) on Tuesday, Sept. 15. It is desired to take the opportunity, which is not likely to recur, of inspecting the street, flood, landscape, and store lighting, which has been organized in connection with the International Illumination Congress.

Motor coaches will leave 28, Grosvenor Gardens, S.W. 1 (where the Council Chamber and the Library will be open for the convenience of members), at 8.15 p.m. precisely, and return there at 11 p.m. Application has been made for permission for the motor coaches to enter the Royal Parks.

The motor coach tickets (which have to be surrendered on the coaches) cost 2s. 6d. each, and it is essential that all applications for tickets should be received by the Secretary of the Institution not later than Saturday, Sept. 12, accompanied by an appropriate remittance.

The Railway Companies in Great Britain will issue tickets (available from Sept. 12 to 17 inclusive) at the ordinary single fare and one-third for the journey to London and back, on the surrender of the railway vouchers obtainable from the Institution by members, on behalf of themselves and their guests, attending the above or other functions of the Institution on Sept. 14, 15, or 16.

The President (Mr. J. H. Canning), the Hon. Secretary (Mr. W. E. Price), and the Secretary (Mr. J. R. W. Alexander) represented the Institution of Gas Engineers at the Official Luncheon of the International Illumination Congress at the Savoy Hotel on Tuesday, Sept. 1, and at the Banquet at the Dorchester Hotel on Wednesday, Sept. 2. Among the delegates present at both functions were many representatives from the Gas Industry.

By courtesy of the Gas Light and Coke Company, arrangements have been made for the Council, General Research Committee, and Joint Lighting Committee of the Institution of Gas Engineers to visit the Research and Training Section (Manager, Mr. J. G. Clark, M.Inst.Gas E.) of the Company at Watson House, Nine Elms Lane, S.W. 8, on Tuesday, Sept. 15, from 5.45 to 8 p.m., preceded by tea at 5 p.m.

The visit is being made in order to inspect the valuable and interesting exhibition of gas lighting fittings, equipment, and apparatus temporarily arranged for the official visit to Watson House of the delegates to the International Illumination Congress. Among the exhibits is a wide range of simple and elaborate domestic fittings (arranged to display their appearance to advantage), factory fittings of all types, switch control apparatus, equipment for street, flood, and landscape lighting, raising and lowering gear for centrally suspended lamps, and apparatus for traffic signals, refuges, and signposts. The photometric equipment will be inspected, different demonstrations will be given, and new technical data as to illumination by gas will be available, the whole being the result of intensive research work at Watson House for some time past.

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GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

As a result of the semi-official statements made concerning the voluntary conversion of War Loan and the Government's intention not to impose a special tax on fixed-interest securities, the Stock Exchange presented quite a cheerful appearance for a day or so last week, and British Funds, together with many sections in the Industrial market, showed improvements. Towards the close, however, renewed irregularity developed with some consequent decline in prices.

Business in Gas stocks and shares was somewhat heavier last week; and while prices for the most part remained steady, there were one or two interesting changes. Gas Light £1 units and 3 p.ct. debenture stock recorded the bulk of the business, but both showed slight falls on the week. The latter stock is now procurable at about 60½, thus yielding nearly 5 p.ct., and, being irredeemable and ranking *pari passu* with the other debentures and loan capital as a first charge on the assets and revenue of the Company, forms a very satisfactory permanent investment. European ordinary was in demand at the close, and the price advanced 5 points to par, while Lea Bridge ordinary also hardened 5 to 130½. Imperial Continental fluctuated during the week and finally closed 10 points lower at 300. Bombay £1 shares declined 1s. 3d., and Gas Light 4½ p.ct. debenture fell 2 to 94½. It will be noticed from the Stock and Share List that the particulars relating to the Aldershot Gas, Water, and District Lighting Company have been transferred to the Mid-Southern District Utility Company in accordance with the powers obtained in the Company's new Act.

The Directors of the Alliance and Dublin Consumers' Gas Company have declared an interim dividend of 7⅜ p.ct. per annum on the consolidated stock, the same rate as a year ago.

Current Sales of Gas Products.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Sept.* 7.

The prices for tar products, in fair quantities, remain unchanged, and are as follows:

Pitch is firm at 52s. 6d. per ton f.o.b.

Creosote, for export, varies from 3¾d. to 5d. per gallon f.o.b., according to specification.

Pure toluole is 1s. 10d. to 1s. 11d. per gallon; pure benzole, about 1s. 4d. per gallon; 95/160 solvent naphtha, about 1s. 4d. per gallon; and pyridine bases, 3s. to 3s. 3d. per gallon.

Prices for spirits are *ex* sellers' works.

Tar Products in the Provinces.

Sept. 7.

The average prices of gas-works products during the week were: Gas-works tar, 20s. 6d. to 24s. 6d. Pitch—East Coast, 52s. 6d. to 53s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 52s. 6d. to 53s. 6d. f.o.b.* Toluole, naked, North, 1s. 6¼d. to 1s. 6¾d. Coal-tar crude naphtha, in bulk, North, 5d. to 5¼d. Solvent naphtha, naked, North, 1s. 1¼d. to 1s. 2d. Heavy naphtha, North, 10½d. to 11d. Creosote, in bulk, North, liquid and salty, 3¼d. to 3½d.; low gravity, 1¼d.; Scotland, 3¼d. to 3½d. Heavy oils, in bulk, North, 5d. to 5½d. Carbolic acid, 60's, 1s. 3d. to 1s. 4d. Naphthalene, £9 to £10. Salts, 50s. to 70s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port, it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Sept.* 5.

Orders have not been plentiful during the week, but quotations remain fairly steady. The best grades of creosote oil, however, continue to find a ready market.

Pitch.—Distillers are not offering for forward delivery except in small quantities. Export value is steady at 40s. to 42s. 6d. per ton f.o.b. Glasgow for prompt and 2s. 6d. to 5s. per ton extra for forward. Home market remains dull at 40s. per ton *ex* works.

Refined tar to Ministry of Transport Specification continues in steady call at 2½d. to 2¾d. per gallon f.o.r. makers' works.

Creosote oil.—Production is low and consequently a steady demand exists, particularly for best grades. B.E.S.A. Specification is 2¾d. to 3d. per gallon; low gravity, 3¼d. to 3½d. per gallon; and neutral oil, 3¼d. to 3½d. per gallon—all *ex* works in bulk.

Cresylic.—Quotations remain easy. Pale, 97/99 p.ct., is 1s. 3d. to 1s. 4d. per gallon; dark, 97/99 p.ct., 1s. 2d. to 1s. 3d. per gallon; and pale, 99/100 p.ct., 1s. 5d. to 1s. 6d. per gallon—all f.o.r. works.

Crude naphtha.—Supplies are scarce, but value remains at 4¼d. to 4¾d. per gallon according to quality.

Solvent naphtha.—Stocks are increasing and prices are easy. 90/160 is 1s. 2d. to 1s. 3d. per gallon, and 90/190, 11d. to 1s. per gallon.

Motor benzole.—Valued at 1s. 2d. to 1s. 3d. per gallon f.o.r. in bulk, but few orders are being placed.

Pyridines.—90/160 grade is 2s. 9d. to 3s. per gallon, and 90/140 grade 3s. to 3s. 3d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole:

	s.	d.		s.	d.	
Crude benzole	0	5½	to	0	6½	per gallon at works
Motor "	1	0	"	1	1	" " "
Pure "	1	4	"	1	5	" " "

Trade Notes.

The "Gunfire" Gas Switch.

A leaflet published by the British, Foreign, and Colonial Automatic Light Controlling Company, Ltd., of Bournemouth, describes their new "Gunfire" gas switch for distant control. With this switch the control wire is not enclosed, which the makers claim to be an advantage for many reasons.

"Ideal" Towel Rails.

The National Radiator Company have sent us their booklet dealing with the latest types of "Ideal" heated towel rails in various attractive designs. A feature of these rails supplied in chromium finish is that they are first heavily nickel-plated, experience having shown that this is necessary if the chromium finish is to be lasting. During manufacture each rail is twice subjected to a hydrostatic test pressure of 100 lbs. per sq. in. They are fitted with the patent flush air vent, which obviates a projecting air cock.

Ketton Portland Cement.

In a recently published brochure the Ketton Portland Cement Company, Ltd., have set out for the perusal of all interested in the use of Portland Cement a brief outline of their products from the quarrying of the raw materials to the packing and despatching, together with the tests furnished to them by independent authority. "Ketco" and "Kettocrete" are claimed to be uniform in quality, to reach very high strength quickly, and to show consistent increase in strength with time. Fine grinding is a special feature of Ketton products, ensuring to the cement a high percentage of "flour," rendering it consequently very strong.

Contracts Advertised To-Day.

Retorts.

The Bexhill Gas Department invite tenders for re-setting a bed of through retorts. [Advert. on p. 619.]

The Clacton Urban District Council invite tenders for the re-setting of horizontal retorts. [Advert. on p. 619.]

STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Sept. 4.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
£			% p.a.	% p.a.				
1,551,868	Stk.	Apl. 9	7⅞	7⅞	Alliance & Dublin Ord. ...	102—107	...	105⅞—106¼
374,000	,,	July 9	4	4	Do. 4 p.c. Deb. ...	71—76	...	76⅜
522,655	,,	Aug. 24	7	7	Barnet Ord. 7 p.c.	121—126*	...	...
300,000	1	Apl. 23	1/4⅛	1/9⅜	Bombay, Ltd.	15/—17/6	−1/3	15/3—16/9
174,500	10	Aug. 10	9	9	Bournemouth 5 p.c. ...	14⅜—15⅜	...	...
500,050	10	,,	7	7	Do. B 7 p.c. ...	12½—13	...	12⅞
439,160	10	,,	6	6	Do. Pref. 6 p.c. ...	11—11½	...	...
50,000	Stk.	June 25	3	3	Do. 3 p.c. Deb. ...	60—63	...	...
162,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	80—83	...	...
357,900	,,	Aug. 24	7½	7½	Brighton & Hove 6 p.c. Con.	109—114*	...	...
371,880	,,	,,	6⅔	6⅔	Do. 5 p.c. Con.	104—107*	+2	106½—107
1,287,500	,,	July 23	5	5	Bristol 5 p.c. max.	97—98a	...	...
120,430	,,	June 25	4	4	Do. 1st 4 p.c. Deb. ...	78—80a	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	78—80a	...	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	98—99a	...	...
665,000	,,	Apl. 9	7	8	British Ord.	110—115	...	113—115
100,000	,,	June 25	7	7	Do. 7 p.c. Pref.	110—115	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	77—80	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	97—100	...	...
160,000	,,	June 25	5	5	Cambridge 5 p.c. Deb. ...	98—101	...	...
100,000	10	May 21	6	8	Cape Town, Ltd.	9—10	...	9½—9½
100,000	10	May 7	4½	4½	Do. 4½ p.c. Pref. ...	6½—7½	...	...
150,000	Stk.	June 25	4½	4½	Do. 4½ p.c. Deb. ...	72—77	...	...
696,860	,,	July 23	6	6	Cardiff Con. Ord.	95—98	...	...
237,860	,,	June 25	—	2⅔	Do. 5 p.c. Red. Deb.	99—102	...	...
187,150	,,	Aug. 10	6½	5	Chester 5 p.c. Ord.	85—90b	...	...
98,936	1	May 7	†2/-	†2/-	Colombo, Ltd. Ord.... ...	28/—33/-	...	...
24,500	1	,,	1/4⅜	1/4⅜	Do. 7 p.c. Pref.	17/6—19/6	...	...
609,204	1	Apl. 9	1/4⅜	15'27d	Colonial Gas Assn. Ltd. Ord.	16/—18/-	...	...
296,053	1	,,	1/7⅛	17'67d	Do. 8 p.c. Pref.	17/6—19/6	...	...
2,073,280	Stk.	July 23	6	6	Commercial Ord.	92—95	...	93⅜—95
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. ...	57—60	−2	57½
787,560	,,	Aug. 10	7	7	Croydon sliding scale ...	107—110	...	109
453,100	,,	,,	5	5	Do. max. div.	81—84	...	83½
542,270	,,	Aug. 24	10	7	Derby Con.	120—125c*	...	...
55,000	,,	June 25	4	4	Do. Deb.	65—70c	...	...
209,000	,,	Mar. 5	5	5	East Hull Ord. 5 p.c. ...	72—75	...	...
1,002,180	,,	Mar. 19	†4	†6½	European, Ltd.	95—105	+5	92—101
18,953,033	,,	July 23	5⅔	5⅔	Gas Light & Coke 4 p.c. Ord.	18/6—19/6f	−/3	18/10½—19/6
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	65—68	...	66—66½
4,294,691	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	78—81	...	78½—80
5,694,095	,,	June 11	3	3	Do. 3 p.c. Con. Deb. ...	59—62	−1	60—61½
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	101—104	...	101½—103
2,500,000	,,	,,	—	—	Do. 4½ p.c. Red. Deb. ...	93—96	−2	94—96
161,480	,,	Mar. 5	10	10	Harrogate Cons. 10 p.c. max.	157—162	...	...
82,500	,,	Aug. 24	7	7	Hastings & St. L. 5 p.c. Conv.	95—100*	...	...
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	80—83*	...	...
70,000	10	Oct. 9	‡	10	Hongkong & China, Ltd. ...	13—14	...	...
213,200	Stk.	Aug. 10	6	6	Hornsey Con. 3½ p.c. ...	89—92	...	...
2,800,000	,,	May 21	15	25	Imperial Continental Cap.	290—310	−10	291—307
233,130	,,	Aug. 10	3½	3½	Do. 3½ p.c. Red. Deb.	76—81	...	...
235,242	,,	Aug. 10	8½	8½	Lea Bridge 5 p.c. Ord. ...	129—132	+5	...
2,145,907	,,	Aug. 24	6	6	Liverpool 5 p.c. Ord. ...	95—96b	−½	...
306,083	,,	July 15	4	4	Do. 4 p.c. Deb. ...	79—81b	...	...
165,736	,,	Aug. 24	9	8	Maidstone 5 p.c. Cap. ...	127—132*	...	...
63,480	,,	June 25	3	3	Do. 3 p.c. Deb. ...	57—60	...	...
75,050	5	June 11	†10	†10	Malta & Mediterranean ...	6¾—7¼	...	...
392,000	—	Apl. 2	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	80—85	...	...
171,978	Stk.	Aug. 24	5	5	M. S. D. Utility "C." Cons.	76—81*	...	...
522,992	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	73—78*	...	...
675,000	,,	May 21	†6	†6	Montevideo, Ltd.	80—90	...	...
2,061,315	,,	Aug. 10	5⅔	5	Newcastle & Gateshead Con.	16/—16/9d f	...	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	74—75d	...	...
691,705	,,	Jan. 8	3½	3½	Do. 3½ p.c. Deb. ...	69—71d	...	...
277,285	,,	May 7	5	5	Do. 5 p.c. Red. Deb.	98—100d	...	...
199,940	,,	Aug. 24	7½	7½	North Middlesex 6 p.c. Con.	112—117*	...	...
396,160	,,	Aug. 10	5	5	Northampton 5 p.c. max. ...	74—79*	...	...
300,000	,,	Apl. 23	9	7	Oriental, Ltd.	93—103	...	...
60,000	5	13 May, '15	—	—	Ottoman	0—¼	...	...
205,162	Stk.	June 25	8	8	Plym'th & Stonehouse 5 p.c.	110—115	...	111½
424,416	,,	Aug. 24	8	8	Portsm'th Con. Stk. 4 p.c. Std.	119—124*	...	119
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	76—79*	...	...
686,312	,,	July 23	4	4	Primitiva 4 p.c. Rd. Db. 1911	83—86	...	...
389,813	,,	June 25	4	4	Do. 4 p.c. Cons. Deb.	84—87	...	...
150,000	10	Apl. 9	6	6	San Paulo 6 p.c. Pref. ...	8—8½	...	...
1,736,968	Stk.	Mar. 19	6¼	6¼	Sheffield Cons.	105—107e	...	...
95,000	,,	July 9	4	4	Do. 4 p.c. Deb.	79—81e	...	...
90,000	10	June 11	†5	†5	South African	3½—5½	...	...
6,709,895	Stk.	July 23	7½	5	South Met. Ord.	101½—103½	...	102½—103½
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	112—115	...	...
1,895,445	,,	July 9	3	3	Do. 3 p.c. Deb. ...	60—63	...	61
784,000	,,	Mar. 5	6¼	6¼	Do. 6¼ p.c. Red. Db.	98—100	...	...
1,000,000	,,	July 23	4	5	Do. 5 p.c. Red. Deb.	100—103	...	...
91,500	,,	Aug. 10	8½	8½	South Shields Con.	110—112d	...	...
1,843,795	,,	Aug. 10	6¾	6¾	South Suburban Ord. 5 p.c.	101—104	...	102¼—103
668,837	,,	June 25	5	5	Do. 5 p.c. Deb.	100—103	...	102½
647,740	,,	Aug. 24	5	5	Southampt'n Ord. 5 p.c. max.	76—79*	...	...
121,275	,,	June 25	4	4	Do. 4 p.c. Deb.	77—80	...	...
250,000	,,	Aug. 24	7	7	Swansea 7 p.c. Red. Pref. ...	95—98*	...	96½
300,000	,,	June 25	6½	6½	Do. 6½ p.c. Red. Deb.	99—102	...	...
1,076,490	,,	Aug. 10	6¾	6¾	Tottenham and District Ord.	103—106	...	...
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	99—102	...	100
199,005	,,	June 11	4	4	Do. 4 p.c. Deb. ...	78—81	...	...
85,701	,,	Mar. 19	6	6	Tuscan, Ltd., 6 p.c. Red. Db.	74—79	...	...
310,694	,,	Aug. 24	7	7	Uxbridge, Maidenhead, & Wycombe 5 p.c.	100—105*	...	...
88,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	88—93*	...	...
1,322,220	,,	July 9	7	7	Wandsworth and District: Consolidated	111—114	...	113½—114
436,000	,,	,,	5	5	Do. 5 p.c. Pref.	97—100	...	...
1,013,464	,,	June 25	5	5	Do. 5 p.c. Deb.	100—103	...	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock. * Ex. div. † Paid free of income-tax. ‡ For year. § Div. = 10 p.c. p.a. less tax and less tax on interim dividend.

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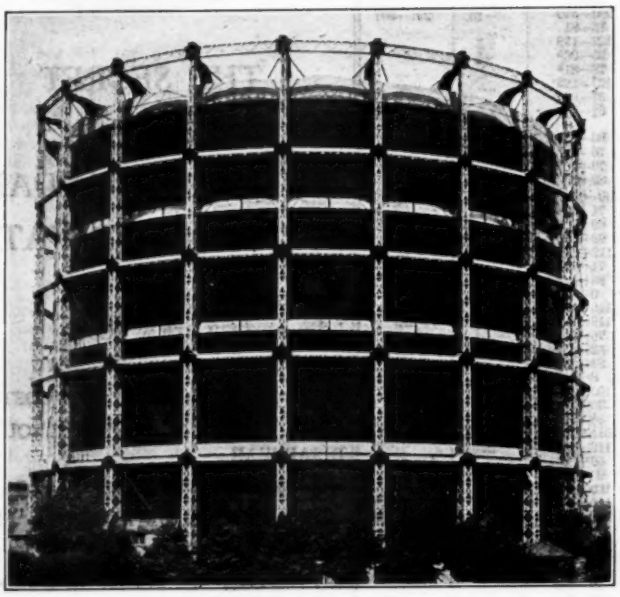

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A copy of the "G.J." Calendar and Directory is presented to Continuous Subscribers.

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(*See advertisement, Aug. 19, p. 440.*)

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CONTRACTS OPEN.

CLACTON URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TENDERS are invited for Re-Setting HORIZONTAL RETORTS at the Gas-Works, Clacton-on-Sea.

Specification, Form of Tender, and full Particulars of the Work to be done can be obtained on application to Mr. Sydney Francis, M.B.E., A.M.I.Mech.E., Engineer and Manager, Gas and Water Department, Town Hall, Clacton-on-Sea.

Tenders, sealed and endorsed "Tender for Re-Setting Retorts," to be delivered to the undersigned not later than 12 o'clock noon on Wednesday, the 16th of September, 1931.

Tenders received without such endorsement will not be considered.

The Council do not bind themselves to accept the lowest or any Tender.

GEO. T. LEWIS,
Clerk to the Council.

Town Hall,
Clacton-on-Sea.

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(GAS DEPARTMENT.)

TENDERS are invited for the Re-SETTING of One Bed of THROUGH RETORTS.

Specification and Drawing to be obtained on application to Mr. L. G. Humphrys, A.M.I.Mech.E., Gas Engineer, 5, Sea Road, Bexhill-on-Sea.

Sealed Tenders, endorsed "Retort Setting Renewals," to be delivered to the undersigned not later than 12 noon, September 18th, 1931.

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S. J. TAYLOR,
Town Clerk.

Town Hall,
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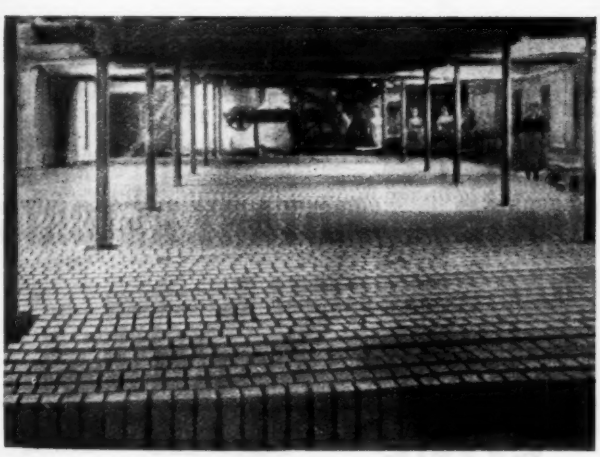

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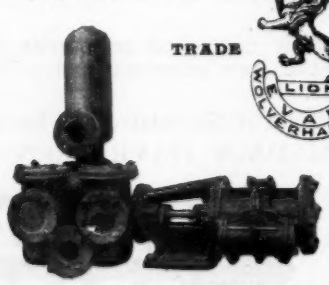

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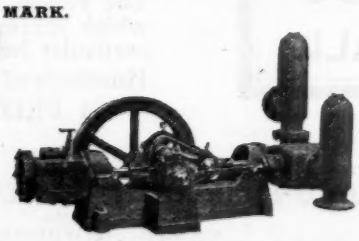

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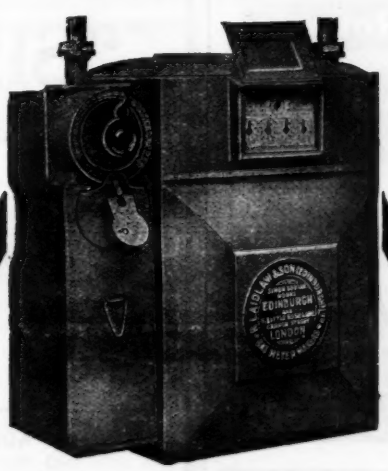

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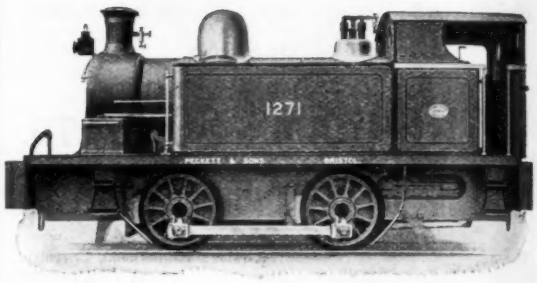

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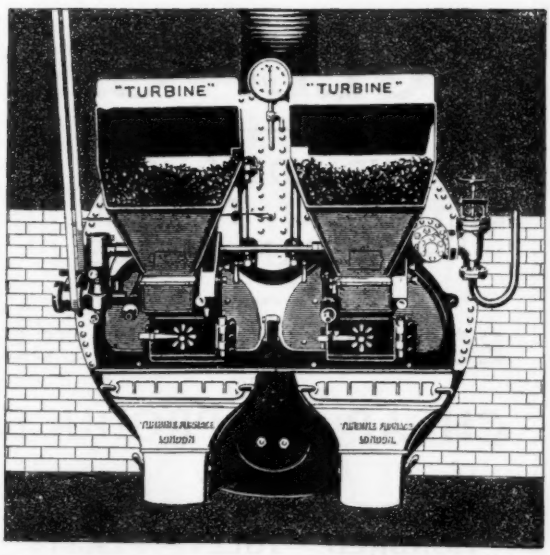

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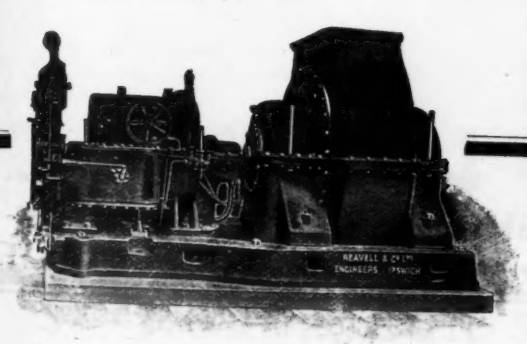

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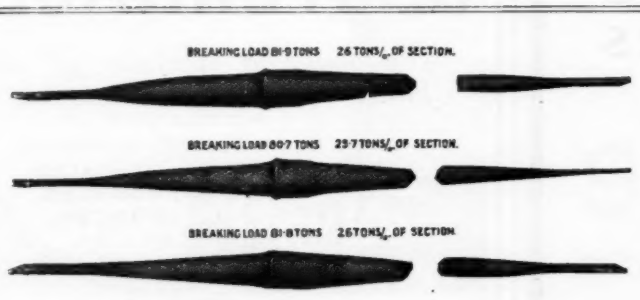
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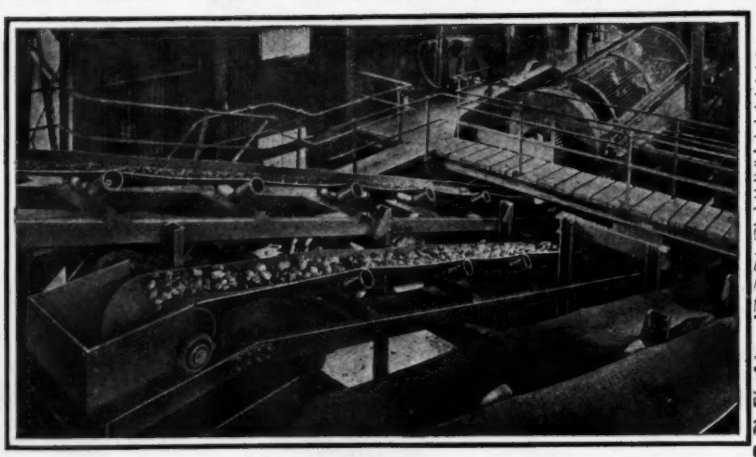

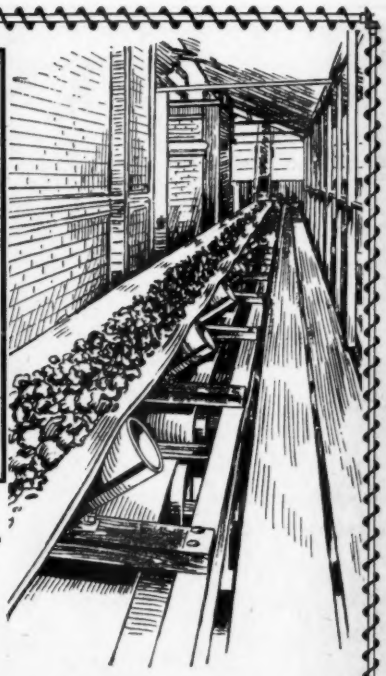

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